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Enamel Margin for Fillings—*Stephan*
Dental Legislation—*Broadbent*
Nasal Deformities—*Sheehan*
Symposium on Root-Canal Filling—*Crane, Blayney, Puterbaugh and Husband*
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Original Communications

THE ENAMEL MARGIN FOR FILLINGS*

By JOHN F. STEPHAN, D.D.S., F.A.C.D., Cleveland, Ohio

AN operator's procedure in accomplishing dental repair depends on his understanding of the minute detail of dental structure. Unity of opinion in this important matter has not yet been achieved, however, and the investigator must weigh and balance many and various conclusions.

A great difference of opinion exists among histologists concerning the character of dental enamel, particularly as to the arrangement of its substance and the possibility of any change taking place in it, after its formation. They are by no means of one mind as to whether reinforcement, or nourishment, is possible either centripetally or centrifugally, or as to whether calcification is completed entirely without the possibility of subsequent metabolic change. Neither are they of one mind concerning the structural arrangement of the prisms.

SHAPE OF PRISMS

Most investigators assert that each enamel prism extends from the dento-enamel junction to the surface of the crown, an opinion which must presuppose an increase in the diameter of the prisms as they pass toward the surface of the crown. Others assert that the prisms are of equal diameter throughout their entire length, presupposing the existence of many supplementary prisms, especially over the more convex portions of the crown.

INCREASE IN SURFACE AREA

Noyes ascribes some increase of area over the convex portions to the fact that though the prisms are generally at

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

right angles to the dento-enamel junction, they are seldom at right angles to the outer surface. But most writers, until recently, lean toward the view that the increase of surface area is accomplished by the addition of sup-

Fig. 1.—Buccolingual axial section of upper molar showing cleavage of straight enamel. (× 25.)

plemental prisms, with or without increase in diameter of the other prisms, which extend the entire distance from the dento-enamel junction to the surface of the crown.

Samuel Wood Chase, whose deductions are in accord with those of J. Leon Williams, Von Ebner and Pickerell, has presented abundant evidence concerning human enamel that the increase in enamel surface is accomplished almost entirely by increase in the diameter of the prisms from the dento-enamel junction to the periphery; that the fact that some of the prisms meet the outer surface obliquely is a very minor factor in the increase of surface; that the interprismatic substance plays no part in the increase of surface, and that, in human enamel, there are no supplementary prisms.

The theory of vital metabolic enamel, which has created such a furor in the recent past through the work of Gottleib, Fisher, Roemer, C. F. Bödecker and others, is apparently fast giving place to the older conception that enamel is nonvital.

ENAMEL PRISMS AND INTERPRISMATIC SUBSTANCE

That the interprismatic substance is quite different from the substance of the prisms is shown by the fact that the interprismatic substance stains blue with Mallory's tissue stain, while the prisms stain red in partially decalcified sections. The two lie closely against each other without intervening substance or membrane. The interprismatic substance, being weaker than the prisms, allows of cleavage along the line of the enamel prisms. This fracture is not always a plain fracture but may be conchoidal; that is, it splits diagonally across a bundle of prisms.

Fig. 2.—Conchoridal fracture in gnarled enamel. (× 120.)

ARRANGEMENT OF PRISIMS

On the tips of the cusps and marginal ridges of the occlusal surface of molars and bicuspids, the prisms are seldom straight throughout their length but are more or less bent and flexed in

Fig. 3.—Buccolingual axial section of upper molar cusp undermined by caries to the apex of the dentin cusp. (× 25.)

bundles about each other. Especially is this true near the dento-enamel junction and through the middle third of the enamel thickness. Such gnarled enamel, as it is called, is generally found to be straight near the surface, and is not so readily cleavable as straight enamel, particularly when it is supported by sound dentin.

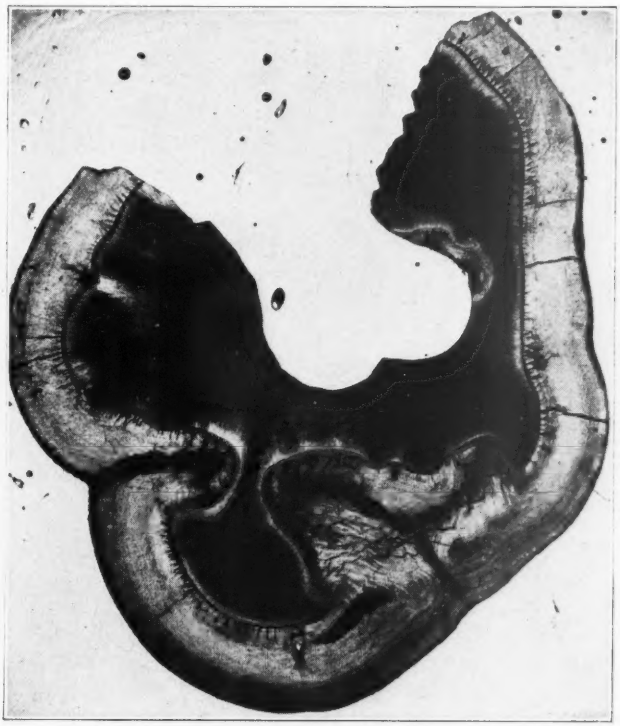

Fig. 4.—Section of upper molar in horizontal plane; enamel margins planed by chisels. (× 12.)

An operator's attention should always be closely directed toward the general trend of the enamel prisms. It is a common opinion that this trend is at right angles to the surface of the dentin. This statement is not complete. The directions of the prisms vary widely in their trend in different portions of the crown while conforming in a general way to this rule. In the gingival third of a bucco-lingual section of a bicuspid or molar, the prisms are inclined more or less apically (from 6 to 12 centigrade) from the horizontal plane; i. e., from a plane drawn at right angles to the axial plane of the tooth.

The trend of enamel prisms can be best described by sections cut through

Fig. 5.—Enamel margins planed by chisels. (× 40.)

the crown, in three planes at right angles to one another—the horizontal, the mesiodisto-axial and the buccolingual-axial or labiolinguo-axial planes. The horizontal plane passes through the tooth at right angles to its long axis; the mesiodisto-axial plane passes through from the mesial to the distal, through the long axis and the central line of the crown; and the buccolinguo-axial plane passes through the central line of the

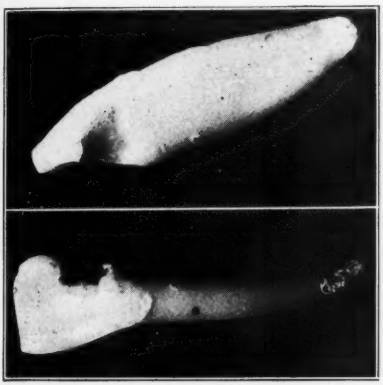

Fig. 6.—Upper lateral incisor. (× 3.)

crown from the buccal to the lingual or from the labial to the lingual.

At some plane between the junction of the gingival and middle third of the surface of the crown, the prisms are in the horizontal plane and at right angles to the long axis of the tooth, and very nearly perpendicular to the surface. From this position, they incline more and more occlusally, until, in the occlusal third, they reach an inclination of 18 to 20 centigrade from the horizontal.

The prisms which form the tip of a buccal cusp do not usually reach the tip of the dentin cusp, but reach its buccal slope. Over the tip of the dention cusp, the prisms are in the axial plane parallel to the long axis of the tooth. Passing down the lingual slope, they incline more and more toward the lingual from the mesiodisto-axial plane. At the developmental groove or pit, they meet the prisms of the lingual cusp, which are inclined in the opposite direction. In the mesiodistal section, the the arrangement is similar, the tip of marginal ridge corresponding to the tip of the cusp.

In incisors and cuspids, the arrangement is also similar, the linguogingival ridge corresponding to a rudimentary cusp. In pits or grooves, the direction of the prisms is often much disturbed, and their irregular twisted arrangement is termed an enamel "whorl."

In the horizontal plane, the prisms run nearly at right angles to the surface of the dentin, except where they approach a groove or developmental line, when the rule for the trend of prisms in grooves and developmental lines on occlusal surfaces applies.

I believe that after enamel, the calcified product of the ameloblast, is completely formed, it is incapable of repair or reproduction. It is the hardest and densest of all the structures of the human body and is quite inanimate, contrary to the opinion of Fisher, Roemer and others. During the formative period, the metabolic disturbances which affect all the tissues of the body affect this process also, but after about the sixteenth year, when the enamel of the human teeth is usually complete, no metabolic change in its structure is possible. Because of this, the addition of calcium systemically is futile.

OCCURRENCE OF BACTERIAL FILM

Recent work of S. W. Chase has shown that, when the tooth is completely erupted, what has been known as Nasmyth's membrane, that is, the remains of the enamel organ, disappears from the crown of the tooth and is replaced by a bacterial plaque such as that described by W. D. Miller and J. Leon Williams.

Chase found this film on 84 per cent of extracted adult human teeth occupying the susceptible area, hereafter to be described.

IMMUNE AND SUSCEPTIBLE AREAS

When many lines are drawn parallel to the long axis of the tooth and tangential to the crown, a line drawn through their points of contact describes a curve known as the "height of contour." The gingival line describes another curve about the neck of the tooth with a convexity toward the occlusal or incisal on the mesial and distal surfaces, and a concavity on the buccal, or labial, and lingual. These lines are more or less constant in position. Another line, known as the gingival border, marking the highest point of the free edge of the gingiva lies between these and represents the curvature of the gingiva. This is parallel to neither the height of contour nor the gingival line and is variable in its posi-

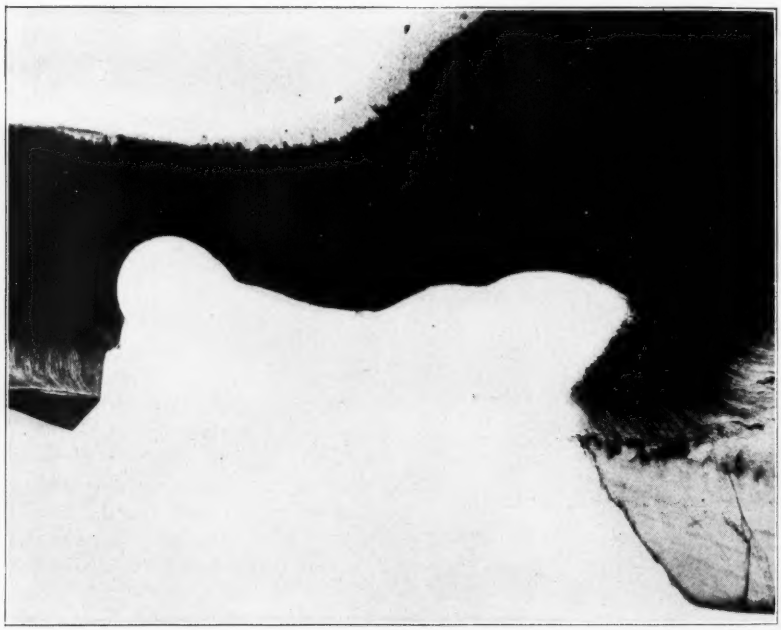

Fig. 7.—Incisor shown in Figure 6. The enamel margin was finished or trimmed with finishing burs. (× 40.)

tion according to the health and age of the tissues of the gingiva. The anatomic form and position of teeth is such

Fig. 8.—Mesiodistal axial section of lateral incisor, showing the trimming of the gingival border by the use of the finishing bur. (× 5.)

that the portion of the crowns lying to the occlusal or incisal side of the height of contour is traversed by food during mastication and by the excursions of the lips, cheek and tongue. With the exception of pits and fissures, this is the so-called "clean" or "immune" area.

The portion of the crown lying between the gingival border and the gingival line is also immune to caries. Between the clean area, which lies to the occlusal and incisal side of the height of contour, and the immune area, which lies between the gingival border and the gingival line, is an area which circumscribes the crown, and known as the "susceptible" area. This is the area of

Fig. 9.—Section of incisor shown in Figure 8. The gingival border was trimmed by the use of the finishing bur. (× 120.)

uncleanliness, or the area in which primary caries takes place. This is the location of the bacterial film described by Chase, the significance of which must at once be apparent. Williams states that he has never been able to cleanse the interproximal surfaces sufficiently to prevent the rejuvenation of the bacterial film within a few hours, while Chase asserts that this film is rejuvenated in all instances, even after thorough removal by brushing with abrasives, in about three days reaching the stage where it simulates Nasmyth's membrane.

Caries seldom passes the axial line angles of the crown. In fact, Black says that, in his experience, only in one case in 1,000 did caries extend beyond them. It is evident, then, that the buccal and the lingual margins of proximal cavities should be carried well toward these lines for safety.

The spaces between proximating teeth which become broader from the contact points toward the lingual and toward the buccal or labial surfaces, and known as interproximal embrasures, increase the area kept clean by the excursion of food during mastication, thus reducing the size of the susceptible area.

The three general areas in which decay is commonly initiated, therefore, are the pits and fissures, the proximal surfaces and the gingival third of the lingual, buccal and labial surfaces.

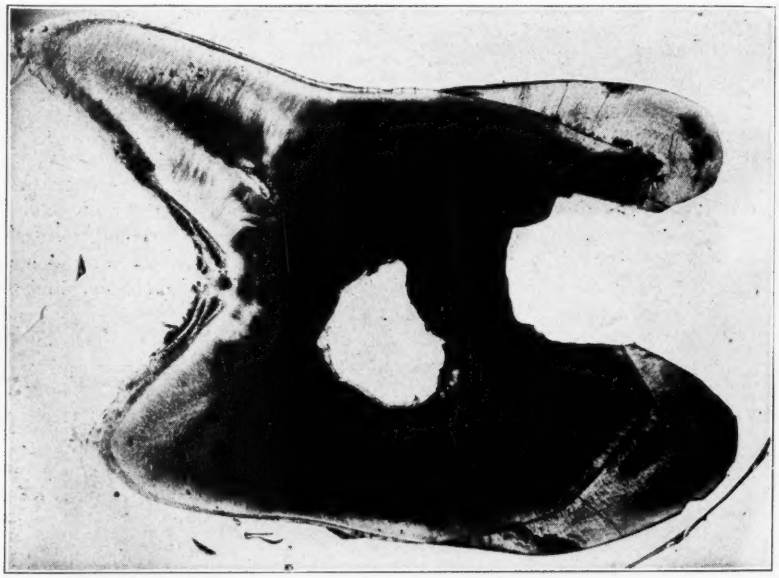

Fig. 10.—Pit and fissure cavity in an upper molar. The margin was trimmed by a stone. (× 10.)

BLACK'S OBSERVATIONS

Black states:

Caries of the teeth is not dependent upon any condition of the teeth, but upon the condition of their environment.

Imperfections of the teeth such as pits, fissures, rough or uneven surfaces, and bad forms of interproximal contact are all causes of caries, only in the sense of giving opportunity for the action of the causes that induce caries.

The objects that are to be attained in filling teeth are the perfect exclusion of the causes of caries from the tissues and securing such form as will prevent lodgments of débris about the margins of the filling, and thus prevent the further action of the cause of caries.

There is no basis for the supposition that some teeth are too soft or too poorly calcified to bear filling with gold or other metal in use for that purpose, since all are found to be abundantly strong for the selection and adaptation of filling material to soft teeth, hard teeth, frail teeth, or poorly calcified teeth. With our present knowledge the only basis for the selection and adaption of filling materials to classes of cases is the individual operator's judgment as considering the circumstances, his own skill and the durability of materials.

Fig. 11.—Enamel margin pit and fissure cavity (upper molar) trimmed by a stone. (× 40.)

STRENGTH OF ENAMEL

Since variations in the degree of density in teeth are extremely limited, being less than 5 per cent, all teeth may be considered sufficiently strong to warrant the use of gold in filling.

Clinically, the teeth of the young and the young adult are found to be strongest, and those of advancing age, more and more brittle. Old enamel seems to me to be much like Zanzibar gum or amber, becoming, with age, more dense and brittle, not through chemical change, but through gradual loss of its water of calcification. Enamel naturally desiccated, like enamel dried by a compressed air blast, is more easily cleaved. This increased brittleness calls for greater protection of the enamel margin. Since enamel cannot react to injury, and since it cannot be reproduced when once destroyed, it is a matter of grave interest to an operator that he do his utmost to protect it against recurrence of destruction, as well as to replace diseased tissue already removed.

ENAMEL MARGIN PATTERN

All pits or fissures are not necessarily carious; but whenever the exploring needle, and mouth lamp, reinforced by radiographic examination, reveal a carious condition, the marginal outline should be extended into the smooth area. Caries in any part of a pit or fissure makes it unsafe to cease excavation until the entire defect has been removed, since the object is to protect adequately and assure immunity against recurrence of decay. Especially should all undermined enamel be removed. Since fissure cavities are most apt to occur along the developmental lines, it it necessary to pass beyond these lines whenever they are involved. In pit and fissure cavities, the enamel prisms converge from the dento-enamel junction toward the surface of the crown, and it is, therefore, not necessary to bevel the margins because the remaining enamel prisms are supported by sound dentin.

INSTRUMENTATION

When a marginal ridge has been broken by the undermining of caries or has been cut by a dentate or inverted cone bur, the enamel is easily cleaved by the use of chisels and hoes until the desired cavity outline has been established. This is true when the prisms are straight, but when they are gnarled, curled or much twisted, as found in enamel whorls, or along developmental lines or in pits or fissures, it is exceedingly difficult to cleave it, to produce a

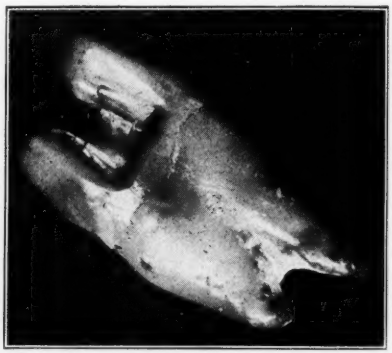

Fig. 12.—Proximoclusal cavity in a bicuspid. The enamel margin was trimmed by a stone. The straight axial walls have rounded gingival angles.

good enamel margin, especially when the portion to be cut is supported by healthy dentin. Here, the bur and stone are most useful.

Enamel is so resistant to hand instrumentation that I find it advisable to use the chisel solely to break down the mass of undermined material, trimming the wall in line with the length of the enamel prisms as near to the cavity outline as possible. Following this with a finishing bur or a carborundum stone, either round or pear

shaped, I finish the bevel, which is the outer third of the enamel wall, with a finely cut finishing bur or stone, carborundum disk or strip.

Just as the cavity should be of such form as to facilitate filling it, so the enamel margin should be smooth and continuous, to allow the most skilful adaptation of the filling material.

rather than straight lines or sharp angles. In proximoclusal cavities, the buccal and lingual walls should be trimmed from a point on the marginal ridge buccally, or lingually from the contact point, following the line of the immune mesial and distal axial angles, into the immune area, to a point below the free margin of the gingiva; then,

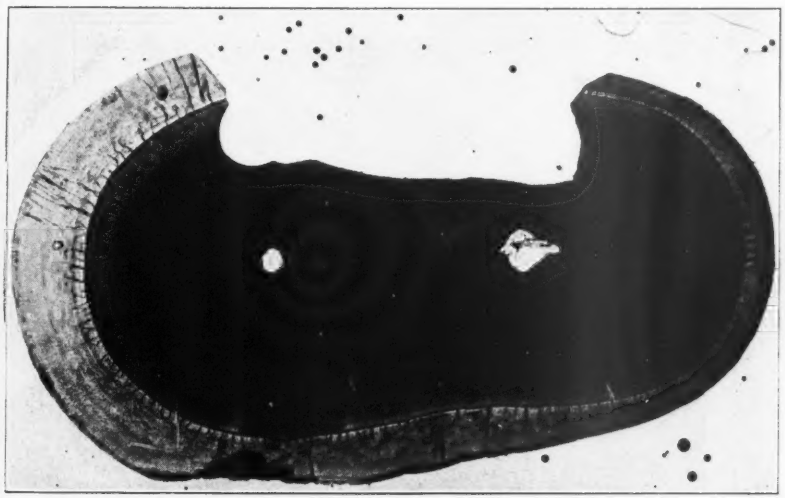

Fig. 13.—Section of a bicuspid in the horizontal plane. The enamel margin was trimmed by a stone. (× 15.)

The enamel margin in the proximal portion of the proximoclusal cavities (trimmed in line with the trend of the enamel prisms,) should always contemplate straight lines joined, not by sharp angles, but by rounded angles. This should be done with no consideration for the necessarily sharper angled retentive form of the cavity. In pit and fissure cavities and on the occlusal portion of proximoclusal cavities, the design of the cavosurface outline should be that of a series of continuing curves after an abrupt curve (not at a sharp angle, as is often advocated), the gingival wall should be cut straight across the gingiva. The gingival outline should be straight, except in the anterior teeth, where it may follow the curvature of the gingival border with its convexity toward the incisal. Its inclination toward the cavosurface would be in line with the trend of the enamel rods, approximately from 6 to 12 centigrade.

The tissue removed must include all undermined enamel, so that the remain-

ing prisms rest on sound dentin, and must also include all affected enamel. This is best detected by a thorough drying of the surface and the use of the mouth lamp. There is no condition under which an operator could be justified in allowing the proximal enamel margin to be left in contact with an adjacent tooth.

relatively immune to decay, as well as free from the destructive forces of mastication. The mesiolingual and distolingual walls of proximal cavities in the lower molars and bicuspids should be extended more to the lingual side, and the mesiobuccal and the distobuccal walls of the upper molars and bicuspids more to the buccal from the contact point, so that they may terminate in

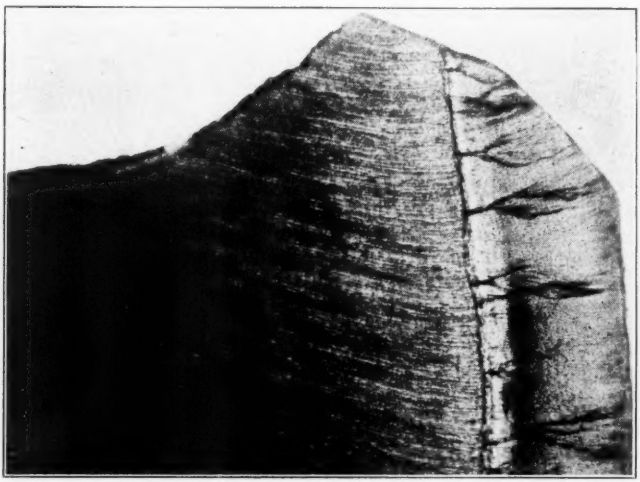

Fig. 14.—Section of a bicuspid in the horizontal plane. The enamel margin was trimmed by a stone. (× 15.)

OCCLUSAL STRESS

The operator must thoroughly consider the occlusion of the teeth, for unless he is familiar with the stress and strain that will fall on the filling or on the remaining enamel walls, he is unable to give the cavity a proper protective design. While considering stress and strain in the effort to so design a filling that it will meet the forces of mastication, he must lay great emphasis on placing the outline of the cavity so that all margins are located in an area immune areas, because the excursion of food does not so readily pass these angles on account of the way in which the lower teeth occlude with the upper.

In some instances, it may be necessary to increase the mesiodistal diameter of a tooth in order to increase the interproximal embrasure so that greater extension can be secured buccally in upper proximoclusal cavities and a greater extension lingually in the lower proximoclusal cavities.

In preparing the enamel margin,

there is one exception in which it is permissible to allow enamel unsupported by dentin to remain. This is in the forming of cavity outlines in anterior teeth to preserve the symmetry of the teeth. This is the so-called esthetic form of enamel outline.

The preservation of the tooth should always be the paramount consideration. Wherever possible, the labial enamel

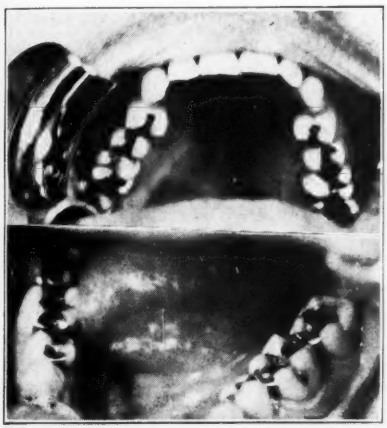

Fig. 15.—Early susceptibility. For twenty-five years after operation there was immunity.

should be retained so that little gold will be displayed.

Just as it is necessary to carry enamel margins into sound tissue in preparing cavities in pits and fissures, it is a good rule, because of the weakness of the enamel along the developmental lines, to extend a margin falling in these areas beyond them into sound enamel.

As in the preparation of cavities in pits and fissures it is necessary to carry enamel margins well into sound tissue, so, since the prisms are weak at all developmental lines, it is a good rule to carry the enamel margin and approaching lines beyond them into stronger enamel or beyond the lines of fusion of the lobes. Likewise, if cusps are undermined, the enamel margin should be placed well over the crest of the cusp in order that the enamel prisms may be trimmed to rest on sound dentin, and that the filling may protect the weakened cusp against destruction.

Because of the bacterial plaque lodged on the susceptible area, heretofore described, processes of decay find protection in the interproximal areas. The prophylactic value of a proper form for proximal fillings is of utmost importance; likewise is the placing of the cavosurface in immune areas in order that recurrence of decay may be prevented and the interproximal tissues preserved in health. For this reason, it is necessary that the crown be of full mesiodistal breadth, and its restoration to full anatomic form, preserving the proximal contact, is essential.

We have discussed the enamel margins for the cavities beginning in pits and fissures; those beginning in proximal surfaces of bicuspids and molars, and those beginning in proximal surfaces of incisors and cuspids which do not require restoration of the incisal angle. In cavities in incisors and cuspids which do involve the restoration of the incisal angle, the enamel margin must follow the design of the retentive form of the cavity, the bevel of the cavosurface margin following the trend of the enamel prisms, modified only by a comprehensive consideration of the necessity of an esthetic form; in other words, a design to display as little of the objectionable gold as possible.

Cavities occurring in the buccal and lingual surfaces of bicuspids and molars, and on the labial or lingual surfaces of the incisors and cuspids, not pit cavities, are known as smooth-surface cavities. In all the teeth these cavities begin close to the gum margin. The distance from the gingival line will depend on the length of the free margin of the gum. When they occur in the young where the gum margin is long, they will begin some distance from the gingival line, leaving a good margin of enamel.

There is usually a streak of softened or affected enamel running away from the cavity mesially and distally.

In the preparation of these cavities, all the areas of uncleanliness, including the last traces of softened or affected enamel, must be removed. The occlusal line of the cavity margin should be placed so far occlusally that it will be kept clean by mastication, and the gingival margin so far gingivally that it will be well covered by the gingival tissues, and the mesial and distal margins should be at the most favorable points near the mesial and distal angles of the crown.

The main point in the successful treatment of dental cavities is the study of the area of susceptibility and the cutting of the enamel margin to avoid this area.

EXTENSION FOR PREVENTION

Extention for prevention is a method of making the outline of the cavity in such a manner that all the margins will be in an area relatively immune to caries. This doctrine is not one of ruthless destruction of tooth structure. The entire scheme was developed before the advent of the inlay and contemplates a system of such excellence in accomplishments that it taxes the skill of the most exacting operator and merits his admiration.

Throughout this discussion as well as in my own practice, I have been greatly indebted to the work of G. V. Black, that master of dental investigators. Back of every movement for the amelioration of the ills of humanity, as well as for its progress, will always be found the figure of some great-hearted man who patiently applies his skill to the solution of human problems. Beyond controversy, Black is the figure here. When he propounded the doctrine of *extension for prevention*, he added an untold measure to the comfort of human kind and laid his professional colleagues under perpetual obligation. During the last generation, he has contributed more to the progress of dentistry than has any other investigator. It is impossible to pay adequate tribute to so great a genius. To voice sincere appreciation of his work is an honor, and it is our high privilege to follow his example in the careful analysis of problems and the thoughtful and painstaking execution of artistic and permanent building of dental structures.

SUMMARY

1. The direction of the enamel prisms determines the shape of the enamel wall, and, consequently, the position of the enamel margin.

2. The weaker interprismatic substance usually determines the direction of cleavage of enamel.

3. Nasmyth's membrane is not found on the erupted tooth, but a bacterial film simulating it is found.

4. The pattern of the enamel margin must seek immune areas from which the bacterial film may be cleansed.

5. Stones and finishing burs produce a better enamel margin than hoes and chisels.

6. The procedures here advocated are found by experience to protect the teeth from a recurrence of caries in the affected area in a high percentage of cases.

1038 Keith Bldg.

DISCUSSION

C. N. Johnson, Chicago, Ill.: A study of the enamel margins bordering decayed cavities in teeth is essential if operations are to be made which will in any sense be permanent. A faulty enamel margin around a filling is a direct invitation for the carious processes to bring about a recurrence of decay, with the result that the operation must be classed as a failure. The more we study principles, and apply these principles in the technical carrying out of our work, the nearer we will come to operations which will stand the test of time and service, and no filling is any more secure than is the perfection of the enamel margins. Dr. Stephan has touched on some very significant things connected with this subject, and his teaching is sound. One thing in particular needs emphasis in any consideration of the preparation of enamel margins, and that is the tendency of enamel to cleave in certain directions. This tissue will stand enormous stress when the force is applied against the sides of the enamel prisms or when the prisms are supported by dentin. If it cleaves, it does so in line with the prisms and not across them, this proving that the most vulnerable part of the enamel is the cement substance which holds the prisms or rods together, or, as Dr. Stephan calls it, the interprismatic substance. Therefore, in beveling enamel margins in cavity preparation, the general direction of the prisms must be studied at any given point along the cavity outline, and the bevel so made that the peripheral ends of the rods are cut off, leaving the dentinal ends standing on dentin. If, through any inadvertence, the dentinal ends of the prisms are cut away leaving the peripheral ends without support, it is only a question of a short time till these ends drop out and leave a crevice around the filling, which, of course, is the forerunner of a failure. One of the difficulties in formulating rules for the degree of bevel to be given enamel relates to the fact that the direction of the rods varies in different locations along the cavity outline, so that a proper protection of the enamel calls for a different degree of bevel at different points. Not only this, but another consideration is called for—the enamel must be better protected in those regions where the greatest stress is brought to bear in mastication. For the proper protection of enamel more bevel must be given in the occlusal and incisal regions, where the impact of food is severe, than at the gingival, where there is no lateral stress at all. There must also be a consideration of the degree of overlap of the filling material. If the bevel is too great, the margin of filling covering it will be so thin that it will lack strength, and will thus be a poor protection to the underlying enamel. In this very connection, the bevel must be somewhat regulated by the character of the filling material to be employed. A greater degree of bevel may be used with gold foil than with amalgam, because of the greater strength of gold over amalgam. Probably, a longer bevel may be given where a gold inlay is used than for any other kind of restoration, and this is one recommendation for the inlay, just as is the friability of amalgam when left with thin edges a contraindication for its use. While no invariable rules can be given for beveling enamel margins, there is one encouraging thing connected with it, and that is the fact that an observant and experienced operator can readily determine by the "feel" of the enamel under a chisel just when the proper degree of bevel has been reached and the margin is safe against disintegration, just as he can tell when he has trimmed the enamel back far enough with a stone or disk. Experience is after all the best teacher, and this relates as well to the preparation of enamel margins as to all the other activities of life. Dr. Stephan has referred to another thing which, at this particular time, needs emphasis. While only indirectly concerned with the topic under discussion, it has so much to do with the character of the enamel that it is worthy of the most careful consideration. This relates to the possibility or impossibility of changing the structure of the enamel after it has once been formed in the mouth. It has been the ambition and even the hope of some men to so improve the structure of the

enamel by a suitable diet that the tooth would be immune to decay. Numberless experiments have been made to prove that this was possible, and, in very many instances, the manifestations of dental decay have been so modified as to lend color to the theory that the enamel might be changed. Mouths which before have been highly susceptible have been transformed to a state of comparative immunity, and mouths which were immune have been made susceptible. But there is one factor which must needs not be overlooked: that the varying manifestations of susceptibility and immunity may be due, not to a change in the enamel structure, but to a change in the environment of the teeth. In other words, there has not been one manifestation in these reported cases which might not readily be accounted for by a change in the fluids of the mouth; and, in a reasonable survey of the situation, it is easier to conceive of a change in the environment than in the enamel. The enamel, the most stable tissue in the body, is not subject to the same laws of waste and repair as are other tissues. If a break occurs in a bone, or a piece of soft tissue is torn away, Nature makes an immediate effort to repair the injury by a proliferation of new cells, but if a piece of enamel is broken off, Nature makes no effort to reproduce it. Probably we shall find, as the result of investigations being made by some of our present-day scientists, that there is a more intimate relationship between the enamel and the other tissues of the tooth than we have heretofore supposed, but it may well be doubted that we shall ever find such a relationship as will admit of producing any material effect on the enamel by diet after the enamel has once been formed. Such a theory does not accord with what we already definitely know about the enamel, and it will be more profitable for us to study the character of the environment of the teeth in any search for a preventive of dental disease than to try to account for the process on the supposition that we can build up a resistance in the enamel structure itself. It is safer to proceed on the theory that we may be able to change the environment, rather than that we can ever change the enamel; and while we have a great deal yet to learn about this structure, everything which we now know points to the improbability of any reaction of the enamel to the influence of the circulation or of diet, at least to any such extent as would account for varying tendencies to susceptibility or immunity. In view of the fact that the enamel forms the protecting covering of the teeth, and that it is the first tissue we encounter in making repair of carious cavities, we need to know everything possible about the physical character of this structure, and Dr. Stephan's paper will prove a great aid in this direction.

W. D. Tracy, New York City: It cannot be gainsaid that a thorough understanding of the histologic structure of dental enamel is a fundamental requisite to the intelligent and successful preparation of cavities in the human teeth. A general understanding of the arrangement of the enamel prism is essential. Dr. Stephan has included some interesting comments on the biology of the structure of enamel, which is now the subject of much study and research. While this subject, in my opinion, is not strictly germane to the mechanical treatment of enamel margins in cavity preparation, I will say in passing that the limited information that I have concerning it leads me to differ with Dr. Stephan. The general principles enunciated in regard to the protection of the enamel at cavity margins are, I believe, accepted by all competent operators. In discussing pit and fissure cavities, Dr. Stephan calls attention to the fact that the enamel prisms tend to converge from the dento-enamel junction toward the surface of the tooth, this rendering it unnecessary to bevel cavity margins because the prisms are supported by sound dentin. As far as small fillings of gold and amalgam in cavities of this type are concerned, I quite agree, but if the cavity requires a gold inlay, as is often the case after proper extension, it is my opinion that a better result is obtained by beveling the margins, even though the marginal prisms are supported by sound dentin. In preparing cavities for gold inlays, a so-called "butt seam" should be avoided wherever possible. Cavities prepared with a beveled margin permit a closer, and in my opinion, a better adaptation of the gold to the enamel in the finished piece of work. Concerning the location of the cervical margins of proximal cavities in bicuspids and molars, I feel that there should be some latitude, or, to put it another way, there are many instances in handling this type of cavities in which it is not necessary to lay the

cervical margin under the free margin of the gum. Whenever possible, all cavities for gold inlays should be dressed down with fine, small stones, finishing burs or disks, as, it seems to me, there can be no question that margins so finished are more nearly perfect than can be obtained by the use of the chisel only. Photomicrographs showing the contrast between enamel finished by means of rotary instruments and disks and that finished with chisels have been shown in the past in proof of this point. Speaking of the removal of all enamel which is unsupported by dentin, it is safe to say that this should be the general rule, but there are exceptions, especially in the preparation of cavities in bicuspids and molars, in which a cavity lining of cement is being used when it is advantageous to leave certain portions of such enamel. The comment of Dr. Stephan in regard to the necessity of extending the mesiolingual and distolingual walls of all proximal cavities toward the lingual side in the lower bicuspids and molars and bringing the margins of all such cavities more toward the buccal in case of the upper bicuspids is worthy of some emphasis. This is a point quite commonly neglected and is the cause of the failure of many fillings which have in all other details been well engineered. In the case of smooth surface cavities, there is no doubt in the mind of any thinking dentist about the necessity of removing every trace of disintegrated and defective enamel; yet how many of the fillings placed in these cavities fail for lack of attention to this detail. The operator who leaves such enamel in his desire to conserve tooth structure is defeating his own objective and merely perpetuating an injustice as regards his patient. The most important paragraph appearing in the essay is the one which states that "the main point in the successful treatment of dental cavities is the study of the areas of susceptibility and the cutting of the enamel margin to avoid this area."

LEGISLATION TO REGULATE ALL ADVERTISING DENTISTS*

By T. A. BROADBENT, B.S., M.S., D.D.S., Chicago, Illinois

THE problem of the advertising dentist was present long before dentistry was recognized as a profession.

In the year 1796, Josiah Taft, one of the most noted pioneers in dentistry, advertised his superior ability to repair and replace human teeth. During the first half of the nineteenth century, it was customary for the best dentists to advertise, by the use of pamplets and in the newspapers. The Code of Ethics in the early days was entirely different from our present day code.

Before attempting to suggest methods for regulating the present-day advertising dentist, let us consider what his status is; what influence he is having on the profession and whether he is a detriment or a benefit to the public.

After I had accepted the invitation to present a paper at this time, on the subject announced, I sent the following questionnaire to the secretary of every state board of dental examiners in the United States and the District of Columbia.

1. About what percentage of dentists in your state are advertisers?
2. To what type of advertising do they resort?

*Read before the Section on Dental Legislation at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

3. Do they live up to their advertisements?

4. Is there any provision in your law that requires them to live up to their advertisements?

5. If so, is any attempt made to see that the law is enforced?

6. Is it the business of the dental board to prosecute violators of the dental laws?

7. Have you any other information or suggestions?

Forty-nine questionnaires were sent out, and forty-three replies were received. The secretaries of the following state boards did not reply: Arizona, Georgia, Idaho, Kansas and Minnesota, and the District of Columbia.

1. About what percentage of dentists in your state are advertisers?

I am going to give in detail the replies to this question, because it is interesting to know in what states dental advertising is most prevalent.

North Carolina leads the states, with the minimum percentage of dental advertisers. "North Carolina has only one so-called advertiser." There are 810 dentists in North Carolina. New Mexico is second, with one advertiser out of a total of ninety-five dentists. Missouri holds third position with less than one half of one per cent.

The percentage of advertisers in all the states from which replies were received follows: 1 per cent or less: Maryland, Missouri, New Jersey, New Mexico, North Carolina, South Carolina, Wisconsin and Wyoming; 2 per cent: Alabama, Florida, Maine, Tennessee and Vermont; 3 per cent: Indiana and Mississippi; 4 per cent: New Hampshire, Oklahoma and Virginia; 5 per cent: Arkansas, Connecticut, Delaware, Illinois, Louisiana, Massachusetts, Oregon, Pennsylvania and South Dakota; 6 per cent: Utah; 7 per cent: Kentucky, Michigan and Montana; 8 per cent: Colorado, Iowa, Ohio, Washington and West Virginia; 10 per cent: Texas; 12 per cent: Nebraska; 25 per cent: California.

From a careful tabulation of replies received, I place the percentage of advertising dentists in the United States at 5 per cent, or 3,250.

2. To what type of advertising do the advertisers resort?

The replies to this question include almost every type of advertising, from newspaper advertisements to extracting teeth in automobiles, with brass band accompaniment. Most advertising seems to be in the newspapers. A majority of the replies state that the advertisements are not particularly objectionable.

3. Do they live up to their advertisements?

To this question, six replies were yes, and thirty-two, no.

4. Is there any provision in your law that requires them to live up to their advertisements?

Thirteen replied yes; twenty-three, no.

5. If so, is any attempt made to see that the law is enforced?

Fifteen replied yes; eight, no.

6. Is it the business of the dental board to prosecute violators of dental laws?

Twenty-five replied yes; eleven, no.

7. Have you any other information or suggestions?

To this question few replied. Some of the replies were very interesting, and I am therefore quoting quite extensively from them.

The following is from Robert R. Gillis, of Hammond, Ind. I have Dr.

Gillis' permission to use his letter provided I make it clear that the opinions expressed are his personal beliefs and in no way voice the opinion of the Indiana board.

The appeal of the advertisers is made by newspapers, handbills, billboards, electric signs, programs; and one office resorted to a house to house canvass by an agent showing samples.

The appeal is through low prices, painless work, secret methods, expert ability in plate and bridge work, free examinations and free cleaning of teeth.

A few reports indicate that the advertisers live up to their advertised claims, but much work needs to be made over.

Judging by the number of reports which say that advertising offices find their territory unprofitable, we can conclude that it is only where large numbers of gullible people reside that advertisers flourish. Laws to save the gullible will never be entirely successful.

The average advertiser's patients appear to be of that class who would not be overly desirable to most dentists.

After twenty-two years of local experience in a community that has had at least two advertising dental offices at all times, I do not consider the advertising dental office as an unmitigated evil.

I consider the average advertiser to be a better business man than the average professional man.

I would not pretend to see the mote in the other fellow's eye while I may have a beam in my own.

I know a lot of "high hats" who advertise but not by means of printers ink. One sort is as black as the other.

Where shall we draw the fine line of distinction between right and wrong?

Probably, all dentists profit from the publicity gained from printers ink that is paid for by the advertising dentist.

The following letter and rules are from Minor J. Terry, secretary of the New York State Board of Dental Examiners:

I am herewith returning your questionnaire.

Under provisions of the education law and dental law, the board of regents has full control of the entrance to and practice of medicine, dentistry, etc. The regents have adopted rules regulating dental advertising, a copy of which I am herewith enclosing. These rules are rigidly enforced. Men who persist in violating them have their right to practice revoked. New York State now has very little flagrant advertising.

RULES

The Board of Regents at its meeting on June 26, 1924, adopted the following rules, defining unprofessional conduct, as a guide in the administration of the law.

1. Advertising personal superiority or ability to perform services in a superior manner.

2. Advertising definite fixed prices that in the nature of the professional service rendered must be variable.

3. Advertising statements that might be calculated to deceive or mislead the public.

4. Employing, associating with or making use of advertising solicitors or free publicity press agents.

5. Advertising either by sign or printed advertisements under the name of a corporation, company, association, parlor or trade name, except that legally incorporated dental corporations existing and in operation prior to January 1, 1916, may continue so operating, while conforming to the provisions of this act. (Subdivision 4 of section 203 of the public health law, as amended by chapter 129 of the Laws of 1916.)

6. No corporation shall display any sign or advertisements concerning its work by use of any name except its true corporate name and the names of the duly licensed dentists practising in connection therewith. It shall not use any parlor or trade name in connection with such corporate name, or display any sign or advertisements, any parlor, trade or assumed name under which business was formerly conducted, except its true corporate name.

Any violation of these rules shall be deemed unprofessional conduct within the meaning of section 201, subdivision 2, of the public health law as applied to dentistry.

Letters with copies of all or part of dental laws were also received from California, Kentucky, Massachusetts, New Jersey, North Carolina and Ohio.

A careful analysis and summary of all the answers to the questionnaire would indicate that:

1. There are so few advertising dentists in the United States that they cannot be a very great menace to the profession, or inflict great damage on an unsuspecting public.

2. Advertising is confined largely to cities of 50,000 population and over, being most numerous and most harmful in cities of 500,000 or more.

3. In a decided majority of the states, the dental advertiser is so well regulated and controlled by dental laws that he is driven out entirely or, if he remains, he is harmless.

4. In some states, he is rendering a real service to the public, because he reaches a class that would not patronize the ethical dentist, and is rendering service that is equal in quality to that given by the average ethical dentist.

It would appear that what is needed in a great many states is more rigid enforcement of existing laws rather than additional legislation with new laws.

It also seems evident from replies received that, in many sections of the country, it has been impossible to get laws passed that would properly protect the public against fraudulent advertisers; also, that where proper laws are on the statutes, frequently it is impossible to obtain convictions, because the sympathies of the juries, judges and public prosecutors are with the fraudlent advertiser.

The great difficulty in the past, in Illinois, has been to get laws to regulate dental advertisers properly, through our legislature, principally because the newspapers have opposed such laws. They want the advertising.

Undoubtedly, this condition prevails in other sections of the country.

CONCLUSION

What the advertising dentist most fears is the revocation of his license. Therefore, have incorporated in your law a clause that gives the state board of dental examiners definite power to revoke a license for:

1. Advertising or publishing fraudulent or misleading statements as to skill, ability or methods used in the performance of dental service.

2. Advertising or publishing any statements or claims regarding fees to be charged for dental service, or the character of service or of the material to be used, if such advertisements are false or are so worded as to deceive or mislead persons desiring dental service.

3. Advertising or publishing any secret or special method of treatment which, in fact, has no proven merit but is used only to attract and deceive the public.

4. Advertising, associating with or making use of advertising solicitors or free publicity press agents, or house-to-house canvassers showing samples of dental work.

5. Conviction of a felony involving moral turpitude, or chronic or persistent inebriety or addiction to drugs, or if the person holding such license shall advertise to practice dentistry without causing pain, or shall in any other manner advertise with a view of deceiving or defrauding the public, or shall advertise the use of any drug, nostrum, patent or other proprietary drug or medicine of any unknown formula, or be guilty of any grossly unprofessional conduct likely to deceive or defraud the public, or which dis-

qualifies the applicant to practice with safety to the people.[1]

DISCUSSION

W. F. Walz, Lexington, Ky.: Dr. Broadbent prefaces his paper with the statement that, in the year 1796, Josiah Taft, one of the most noted pioneers in dentistry, advertised his superior ability to repair and replace human teeth. While Josiah Taft is an interesting figure as far as the early history of dentistry is concerned, what Josiah Taft did or did not do in respect to the subject at hand is of little value or consequence to the dental profession today. In the days of Josiah Taft, there was no dental profession, and consequently no code of ethics to be observed; for, in that day, dentistry was a trade—nothing more nor less, and not only were no educational qualifications required: there was no such thing as even apprentice requirements as there were in most other callings or trades, as they were known in those days. In the present day and generation, dentistry, with its requirements, having elevated itself to a position of dignity, there is much need and demand for a code of ethics commensurate with the high standing our profession has taken, in the past few years, and the proper observance of that code. The advertiser is a blight on the profession, and we should give the best that is in us to eradicate him from our ranks. His methods are a constant menance to the dignity and high standing the better members of our calling are constantly striving to obtain. But a few years back, dentistry was so looked down on by the other professions, and particularly by our sister profession, medicine, that to be a dentist almost meant social ostracism. That day has passed. The better men of the profession have risen nobly to the occasion, and by organization, elevation of ideals and educational qualifications and requirements, we find the profession on a plane at least equal with that of our sister profession. It behooves us to keep our position intact, and one of the essentials to maintain and to advance our position is to hold high our code and to eradicate the advertiser. But how is this to be done? Of course, by legislation, if it were possible; but we must remember that advertising from a professional standpoint and a legal one are two very different matters, and unfortunately, the law makers do not get our point of view. Consequently, it is exceedingly difficult to get laws passed commensurate with our needs. I believe that, eventually, we shall accomplish that end by state legislation, but until we have educated the public and the members of our legislatures, as a matter of public health the advertiser must go. And, while on the subject of education, are our dental schools as efficient in respect to the education of students in ethics as they should be? Many schools have a course on the business side of dentistry, but how many include in their curriculum a proper course in ethics? Why not begin on the dental student in his freshman year and "hammer away" on this subject until he thoroughly absorbs the idea that to become an advertiser is a disgrace and, by a thorough course of study and examinations on the subject of ethics extending through each of his scholastic years, he is thoroughly imbued with the idea that to advertise is to commit professional suicide. Then, too, does the average dentist give as much time and thought to civic, state and national affairs as he should? How many of us feel it our duty to go to the polls and vote? Many of us do not even take the trouble to vote on election day. Most state board men are dubbed politicians because of the fact that they hold an appointive state office made by the governor of that particular state; when, as a matter of fact, few state board members are as much politicians as they should be. And, by politician, I do not mean the common acceptance of the term, so frequently used derisively and confounded with "ward heeler." But the average dentist should be more of a politician (and by politician, I mean one who takes an interest in civic and his country's affairs), and not only take a passive interest, but do his duty by going to the polls and casting his vote, taking his turn serving as an election officer, taking his proper sphere in his party's councils; in other words, one who does his duty as a real citizen. In this manner, we can take our proper place in our communities; we can exert our influence for the good of our community and our profession, and, in time, we can educate the public and the legislators to have a proper respect and conception of our profession and hear our call. I cannot believe that all of Dr. Broad-

1. Dental Law of Kentucky, Section 6, and Dental Law of Missouri, Section 5493.

bent's deductions from his questionnaire are established. 1. What percentage of dentists advertise? I cannot see how it is possible to determine what percentage in a given state resort to legal but unprofessional advertising, except by keeping a strict tab on all of the dentists in a state for a period of time and making figures upon this basis and not on a guess, as I feel certain was the case with most state board reports. One man's guess is as good as another. 3. How are we to determine whether or not they live up to their advertising? It is safe to bet that any one claiming superiority in ability, material or prices is doing so in an endeavor to fool the gullible, and as a prominent advertising dentist said on an occasion when we were bucking the legislative committee, "All advertisements of dentists to be profitable must be fraudulent." As to question 4, most of the laws which I have read seem to be deficient in that the offense is to advertise with fraudulent intent, and it is a difficult matter to prove intent. The rules adopted by the New York regents are indeed admirable, but the weak point is that they are rules of the board and not state law. If the New York courts will permit the board of regents to interpret the law for them, well and good, but I greatly doubt that the courts of any state will stand for this assumption of their duties and rights. The difficulty in administering the law, in the way of license for unprofessional conduct, is that unprofessional conduct from a legal standpoint and a professional one becomes two entirely different propositions. The legal point of view is, broadly, that unprofessional conduct must constitute fraud. In Dr. Broadbent's quotation from Dr. Gillis, he states that the Indiana law does not permit practicing in any name except that of the individual so practicing. This is not only the law in Kentucky, but has been upheld by a decision of the court of appeals. As far as I have been able to find out, Kentucky was the first state to have this law written on its statutes, to summarize: 1. Proper education within our dental schools, of the student body, is imperative, instilling in their young minds the proper value of our Code of Ethics and the need of living up to the standards of that code; not by one or two lectures on this subject, but by a systematic series of lectures and examinations extending through the entire years of study. Make this a part of the school's curriculum and teach our young men to abhor the thought of advertising. 2. Teach the laity and our statesmen that, as a matter of public health, the advertiser should be abolished. 4. By the gradual restrictions of the advertising offices by means of legislation, we shall eventually, be enabled to obliterate them entirely from our ranks. 5. Commercialism should be reduced within our ranks. Not that a man is not entitled to receive a fee commensurate with good service, but the dental manufacturer and dealer should not be allowed to instill too much commercialism into the profession.

SOME FACTS CONCERNING THE CORRECTION OF NASAL DEFORMITIES*

By J. EASTMAN SHEEHAN, M.D., F.A.C.S., New York City

IF I may be allowed, I should like to say a word as to the hopeful significance of this international congress. It represents a conscious effort to assign to each of the recognized departments of dentistry its rightful place in the domain of medicine.

It is clear, for example, that the art which has been developed in the field of dental prosthesis has most interesting and most important application to a wide range of oral, nasal and other facial surgery. It is clear also that there is an area in dental practice where the knowledge and equipment required are those of the surgeon, and where some of the problems presented cannot be distinguished from the problems of surgery and of medicine.

But what is most significant is the fact that, in all countries, as evidenced by this congress, the dental profession is definitely and consciously adapting itself to these truths.

We live in an age of widely diversified specialization, in the very nature of which men here and there come upon something of value. Where such discoveries are sympathetically tested for what is really good in them, they can be assigned their proper place in medicine. Where they are merely scoffed at, the tendency is to develop some new form of "ism" whose practitioners essay to extend the single atom of truth to cover conditions to which it cannot possibly apply. Within the kingdom of medicine, there is place for everything that can combat bodily ills. When, as now, dental and oral surgeons are found discussing together the problems which directly or even proximately interest them both, surely it can be said that the right, the scientific purpose is most apt to be served.

It will only be possible, as an introduction to the lantern projections, to discuss very briefly a few considerations of outstanding interest in relation to the correction of nasal deformities.

DIAGNOSIS

Necessarily, diagnosis comes first. The relations of the tissues must be studied to determine the nature and variety of the abnormalities, for there may be several kinds of these in the same case, and also with the constant thought how best to produce the form that should be evolved and which will show in the final result. As Mayo says, "It is the divine right of every human being to look human," and the operator must have sufficient artistic vision to be able to forsee what form the reconstructed nose is to have and

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

how it will harmonize with the other features. Then he must have the skill to shape the tissues toward that result. Careful consideration must be given, therefore, to all the elements, to the nasal bones, the bridge cartilages, the alar cartilages, the columella, the septum, the looser tissues, membrane and skin covering, and the relations of these or any of them to the maxillae, the cheeks or the lips. Procedures for the correction of the various types of disfigurement are now standardized. It is quite impossible, of course, to describe them here. What is important to bear in mind is that there are many pitfalls, which one can hope to avoid only if from the very outset there is a clear mental picture of what the final appearance is to be. And it is well to remember that the real ultimate result may be produced only many months after the operation, when the processes of Nature have had time to obliterate the traces of traumatic insult.

Fig. 1.—Left: condition; right: correction.

PREPARATION

It should be taken for granted, but it is well to emphasize, that any extra care taken in the preparation of the patient is amply repaid during the period of recuperation. So much of this work can be done, and best done, under local anesthesia, that there is a temptation to pass over some of the precautions by which the condition of the patient is brought to its best at the time of the operation. Particularly is this true of patients of the Northern races, who, for some reason, appear to be more susceptible to infection following surgical exposition than those, for example, from continental Europe. Therefore, it is of prime importance to take precautions against all forms of toxicity, and to be

regardful of the conditions not only in the immediate neighborhood of the nose but also in the intestinal tract and elsewhere. It is not safe to operate in the presence of acne, nor if there is disease of the sinuses, nor if there is any other ascertainable infection. For several days before operation, the face should

Fig. 2.—Condition before operation.

be steamed two or three times daily, and washed even oftener with Ivory soap, and on each occasion the effort should be made to express any comedones that may be present, taking care, always, to avoid trauma. All accumulations of sebum should be cleared away. Care should be taken to extend the cleansing to include the lids and eyebrows as well as the parts about the nose. The interior of the nose should be gently irrigated several times a day for several days also, with a solution of magnesium sulphate. Argyrol can be used, but it has a marked tendency to cake, which is a great objection. A point worth noting at this stage is that the face should not be covered during the operation. Since the nose must be studied in its relation to the other elements of the face, the surgeon is very much in the dark if the nose only is exposed.

METHOD OF ATTACK

Different schools favor different methods of reaching the tissues to be manipulated within the nose. Of the considerations by which a choice should be dictated, some are positive, some negative. One advantage claimed for the intranasal incision is that it eliminates external scar. As against that,

there is greater liability to infection, the strongest agent of disaster, and the difficulty of controlling such infection if it occurs. The advantage of attack via the columella is that, with the septum exposed, access to all the interior tissues is direct, and, therefore, relatively easy. The disadvantage is in respect of external scar. However, this can be minimized, or even wholly eliminated. Even in using the incision on the midline of the columella, the scar may be almost negligible. Where the columella is lifted, the result is still less objectionable, being confined, if it is visible at all, to a tiny line where the columella joins the philtrum. But in a great many cases, it will be found practicable to proceed by retracting the columella to one side, the only incision being along its internal length. In such cases, the advantage of direct attack is gained without the sacrifice involved in even the smallest external scar. But what most of all conduces to the selection of this method of attack is the opportunity it affords of applying force on direct lines. To deal with the nasal bones or the bridge cartilages through the intranasal incision, one is compelled to use instruments whose direction, in the area of operation, is not in direct line with the part where force is applied, but only more or less parallel to it and at some distance from the direct line. It may be that some extremely capable operators learn to control the resulting difficulty, but not all

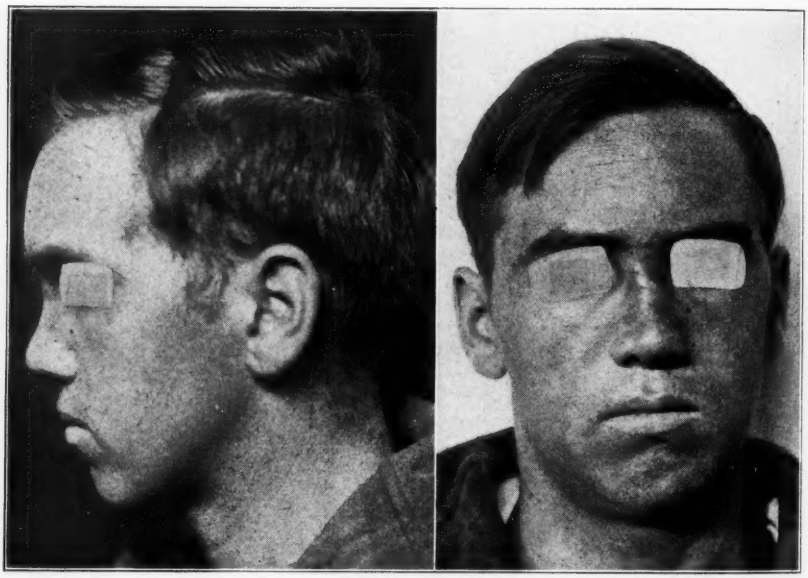

Fig. 3.—Patient after corrective operation, a readjustment of tissues without graft implantation.

who employ the method can substantiate that claim, and it is obvious that the difficulties encountered in manipulating the tissues are already sufficient without the addition of another of such magnitude. There are some types of deformity in which the repair is best effected without recourse to the columella at all, where incision under the alar rim is all that is called for. But where there must be extensive separation of periosteum or perichondrium, or fracture of the nasal bones at the junction with the maxillae, or excision made to reduce the size of the nasal bones, or for delicate readjustments at the nasal tip, balance of advantage, in my experience, is heavily on the side of attack through one or other of these columella incisions.

CHISEL AND SAW

There is some disagreement, also, as between operators, as to the relative merits of the chisel and the saw. The decision seems to me to be governed by the fact that the chisel makes a clean cut, whereas the saw inevitably produces a dust of bone. This, which it is practically impossible to remove, is likely to become an irritant, and therefore may constitute an interference with the repair. Or it may provide, when the osteogenic process is resumed, a focus of hypertrophy, and thus become the occasion of a new disfigurement. Moreover, if the chisel pierces the tissues, no harm seems to be done. An accidental wound with the saw may be more harmful.

Fig. 4.—Appearance of patient before operation.

MATERIALS OF SUPPORT

In the matter of the material best suited to form a support, to add height to the bridge or to replace one entirely or partially missing, there is now a very general acceptance of the preeminent suitability of autogenous cartilage. At least, no one any longer questions that it lives and is welcomed in the tissues of the nose, that it does not disintegrate, and that it is not expelled. But there are some who, shrinking from the necessity of inflicting a serious wound upon the chest, with some attendant risk to the pleura, elect to avoid that course.[1] They are disposed to believe that the support can be given by use of ivory or celluloid, or some other foreign material. The fine grain of good ivory is doubtless the ground upon which this belief, which must be partly a hope, is allowed to rest. Some who use ivory, conscious of the likelihood that it will be expelled, have compromised by decalcifying it, leaving a substance whose consistency resembles that of cartilage. I am informed by some who have tried this method that the decalcified ivory distintegrates and that the result is disappointing in the end. Indeed it cannot be otherwise; for, when disintegration sets in, the process of expulsion begins, and inflammation is the invariable accompaniment. If we are to see clear through to the distant end of a repair, we must include a contemplation of foreseeable breakdown, even though that breakdown may be deferred for a considerable time.

Fig. 5.—Appearance of patient after operation.

1. Since this was written, the author has elaborated a method by which depressions on the bridge are filled by fragments of alar cartilage saved after readjustment of the tissues. M. J. and Rec., 125: 585 (May 4); 664 (May 18) 1927.

USE OF PARAFFIN

There are some indications of a similar tendency to compromise with experience in regard to paraffin. There was a time when the profession believed in paraffin injection and manipulation as a sound procedure, and probably it is as difficult for them as for others to unlearn what was once accepted. one who has attempted to extirpate the evils presented in any case of paraffinoma does not need to consult the elaborate studies, with their record of embolism, blindness, etc., to be quite convinced that the material is not one to be injected into living tissues. Nor does one see how the evil principle can be exorcised, against all Nature, at a "small

Fig. 6.—Appearance of patient before and after operation.

March 27, 1926, the *Lancet* announced that "the common small depression at the nasal bridge is best corrected by the injection of a small quantity of paraffin wax, and that the result is quite permanent." Whoever wrote that might change his mind if he could inspect even a few of the cases, now a commonplace with those engaged in nasal repair, which reveal the ravages directly due to paraffin injection. The dissemination of the oil works havoc with the surrounding tissues, and any- depression on the nasal bridge." If it gives support, it must resist pressure. If there is pressure, there will be dissemination, and if that begins, there will be the attendant results with which we are now all too familiar. The breakdown may be long delayed; often it is, but a repair cannot be called "the best," nor the result be considered "permanent," whose only recommendation is a crisis deferred. Besides, the small defect alluded to can be repaired

very readily by the transfer of a small piece of ear cartilage.

BANDAGING

In considering the support to be given to the nose after completion of the procedures, we revert again to what has been said about having a clear view, from the outset, of the form that the nose is to have in the end. The readjusted tissues do, indeed, require some such support, but if their relation to one another has been properly established, they do not require much and they do not require it long. The splint device (exhibited) is designed to maintain the contour during the first two days, but once the normal processes of life have returned in the bones, cartilages and surrounding tissues, the future of the nose lies with them. Bandaging does not help. The first one should be removed at the earliest permissable moment, and light and air be allowed thereafter free access to the face. The constituent elements of the remade nose will the sooner assert themselves, and the result will be what it will be. Time, perhaps a good deal of time, alone will show whether anything that ought to have been done has been overlooked, and whether, as not seldom happens, something else must be done to repair the omission. Patience has a very important part in the general scheme of repair of nasal disfigurement.

Fig. 7.—Appearance of patient before and after operation.

POSTOPERATIVE CARE

Ultimate success depends a great deal on the postoperative care. Frequently, after the bandages have been removed, the appearance is very angry, so much so that there is a strong temptation to incise. In the great majority of cases, continuous application of warm compresses will afford the desired relief.

Much of the trouble is occasioned by lymphatic congestion, and, for that, moist heat is the best remedy. Ringer's solution is serviceable, but even more favorable results can be obtained with magnesium sulphate. Excessive swelling that does not yield to external treatment can be controlled by internal doses of tincture of iron chlorid, 15 drops every three hours. When the lymphatic circulation has been unchoked, the annoying symptoms gradually disappear. Where, despite all precautions, infection does declare itself, prompt recourse to wide incision and drainage becomes necessary. Here, again, moist heat is a great help. All the wounds must be kept thoroughly clean and free from coagulated blood, which harbors infection. This calls for constant watchfulness on the part of the attendant, and constant, not merely occasional, attention by nurses, who should be trained to recognize its importance. Bandages should never be replaced after once being removed. Their only effect then is to impose pressure on the circulation, which impedes healing. Sometimes, when it begins to appear that the best result has not been attained, the attempt is made to secure improvement by resort to massage. The hope is vain. There is nothing for it but to wait until the parts have permanently set, and then, confronted by the new problem, to reconstruct. The important point to remember is that the benefit from a perfectly good operation can be lost by improper postoperative care, and may be saved if the care is good.

THE SYPHILITIC NOSE

The outstanding contribution to surgery, made by those who have concentrated their attention on the repair of nasal deformities, is the successful handling of the problem presented by the frequent occurrence of the advanced type of syphilitic degeneration. Until quite recently, this was one of the unsolved problems, and the despair of the surgeon called on to cope with the condition, which, in the most advanced stage, involves the loss of all the elements of the nose. Total rhinoplasty was often enough attempted; for the failures of others have never deterred the ambitious surgeon; but, until the explanation of failure was discovered, the effort always failed. After continuous observation and study, it was seen that the main cause of failure was the attempt to construct a substitute nose which did not have all the elements of a real nose. A cover and a support had been supplied, the anatomic and physiologic necessity of a lining had somehow been overlooked. Once that necessity was realized, and the operator learned how successfully to implant a lining as well as a cover, the problem of the syphilitic nose was on the way to its solution. It is not to be said that even now the repair can be made without difficulty. It still requires much time, much patience and much ingenuity. In the latter, the judicious use of dental prosthesis plays an important part; but the successful handling of the syphilitic nose, in any of its stages, is no longer to be rated as one of surgery's unattainable peaks.

DIAGNOSIS PRECEDING ROOT CANAL TREATMENT*

By ARTHUR B. CRANE, D.D.S., Washington, D. C.

IN the treatment of disease, intelligent diagnosis is of transcendent importance. Without a definite perception of existing conditions, any treatment becomes empiric and unreliable.

The problem of the pulpless tooth has remained a problem, not because of any natural intolerance for the pulpless tooth, not because of any lack of reparative power in the periodontal tissues, not even because of the almost insurmountable mechanical difficulties involved in root-canal surgery, but because our present diagnostic resources fail to differentiate certain significant tissue changes which are of the utmost importance as ultimate deciding factors in success or failure.

Therapeutic measures which are successful in one case should result favorably in every other case in which identical conditions obtain. Yet it is common experience to approach root-canal work with uncertainty as to the outcome, even though the most exhaustive effort at diagnosis fails to disclose any definite reason to anticipate failure.

That the treatment of pulpless teeth is a tentative procedure is indicated by the universal demand for periodic radiographic observation of all treated teeth, and this uncertainty will continue until diagnostic methods become more efficient.

The pathologic sequence of the pulpless tooth may be arbitrarily expressed as follows: (1) exposure of the pulp to irritation; (2) hyperemia of the pulp, leading to moist gangrene; (3) putrefactive decomposition of the pulp, with gas production; (4) proliferative changes in the apical pericementum, leading to granuloma; (5) denudation of the apical cementum, leading to necrosis of the root apex; (6) infiltrating rarefaction of the periapical bone; or cystic degeneration of the granuloma.

These definite stages of pathologic change, once they become established, are readily demonstrated by methods of diagnosis so well known as to require no elucidation on this occasion; but as they blend so gradually, one into the other, it may stimulate thought to consider the more obscure transitional conditions which occur as the pathologic process advances.

An irritated pulp is easily recognized, but before operative procedure is begun, the exact condition of the pulp should be known. A clinical history of previous pain flashes may be an indication of infection, but it has been

*The papers of Drs. Crane, Blayney, Puterbaugh and Husband make up a symposium on "The Problem of the Pulpless Tooth."

*Read before the Section on Anatomy, Physiology, Materia Medica and Therapeutics at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

satisfactorily demonstrated that pulp infection is not always accompanied by pain. If there is deep decay or advanced pyorrhea, the chances are about even that immediate extirpation of the pulp will be followed by a bacterial invasion of the periapical tissues.

Congestion of the pulp is an almost certain sign of active infection, and certain pulp areas may be gangrenous. Such teeth are hypersensitive to electrical stimuli and the application of either heat or cold causes a painful reaction. As the gangrenous areas increase, the response to electricity becomes more and more sluggish.

The dissolution of the gangrenous tissues causes gas production. At this stage, the application of heat will cause a delayed pain, which will slowly subside on the application of cold.

The most deleterious effect of this tissue liquefaction is the saturation of the dentin with the putrefactive products. While a foul odor is said to be indicative of saprophytic activity, it is evident that a continued foul odor, after the canal is cleansed, is indicative of deep infection of the dentinal tubules. A lack of translucency of the crown of the tooth may also indicate the same condition.

Symptoms of pericementitis may be caused by gas formation, but are not reliably indicative, as the same symptoms may be caused through irritation of the apical pericementum from bacterial invasion of traumatic or chemical injury.

No matter what the cause, irritation of the apical pericementum will be accompanied by proliferative tissue changes. This may amount to no more than a thickening of the tissues, or it may advance until a granuloma is produced. Here, tissue resistance becomes an important, though still obscure, factor.

When there is thickening of the apical pericementum in the absence of inflammatory signs, the possibility of a chronic occlusal traumatism should be considered. If transillumination of the alveolar structures produces a shadow, congestion with stasis is indicated, and infection suggested, but in many periapical infectious processes, there is no shadow.

At first, in some cases, proliferation occurs between the fibers of the apical pericementum. In other cases, it may occur between the cementum and the pericementum. A means of differentiating these conditions in the living subject would be a great prognostic aid.

With the advance of tissue proliferation, a demonstrable granuloma becomes established. This may be a reparative effort or a chronic destructive process. In the latter event, the apical cementum will become denuded.

Denudation of the apical cementum must destroy, or at least seriously inhibit, the nutrition of this highly specialized bone. If, in addition to this interference with nutrition, the apex of the root is bathed in the products of putrefaction, necrosis must soon occur. In the early stages, this is not demonstrable, but later it will be indicated by a roughening, definable in the radiogram. The apical cementum is very thin, and it is probable that, by the time roughness is recognized, the apical dentin will have been more or less exposed.

If the destructive process by which the apex is roughened indicates the activity of active osteoclasts, it is probable that vital cementoblasts may still be present and capable of function. Thus, it is possible that a roughened root apex may still be vital. More often, the

destruction is an expression of phagocytic elimination of necrotic tissue.

When a granuloma becomes sufficiently established to interfere with cemental nutrition, a gradual change occurs in the nature of the disease. In some cases, minute areas of the adventitious tissue undergo a liquefaction necrosis, about which the epithelial débris of Malassez forms in chains. As fusion of the necrotic areas occurs, the epithelium proliferates, matures and forms an enclosing wall, thus changing the granuloma into a cyst. Coincident with these internal changes in the granuloma, rarefaction of the periapical bone gives way to a pronounced condensing process, so that when the cyst is completely established, it is encapsulated in a bony shell, which is definable as a hard white line in the radiogram.

Radicular cysts often become sterile, or so nearly sterile, that growths cannot be obtained from cultures. They cast no shadow on transillumination, and progress slowly and painlessly, unless they become secondarily infected.

In view of the almost constant presence of epithelial remnants in the pericementum, it might be possible that every granuloma would undergo cystic degeneration if infection became dormant, and this would be a natural defensive process. It often happens that a sudden increase in bacterial activity or a decrease in tissue resistance will cause a breaking down of the natural circumscribed line of defense which serves to retard the growth of the primary granuloma, and thus a diffuse proliferation will be established. Spikes of granulation tissue will penetrate into the adjacent bone, causing extensive rarefaction. Certain areas undergo liquefaction necrosis and the defensive processes are no longer active. Transillumination through the alveolus will cast a definite shadow, and the impulse of percussion on the tooth crown will be carried to the finger tip held over the root apex.

Either cyst formation or extensive diffuse proliferation should discourage attempts at root-canal treatment. If it were possible to discover in their incipiency the insidious changes which lead to the metamorphosis of the granuloma, it is probable that many root-canal ventures which now seem justifiable would be definitely contra-indicated.

During any stage in the development of a pulpless condition of the tooth there may be such an abrupt rise in the infectious process, either through a sudden lowering of the vital resistance or the introduction of more virulent bacteria, that an acute alveolar abscess will be produced. This may quickly run its course, after which the pathologic sequence will be somewhat advanced or it may become chronic and cause continuous destruction of tissue. The presence of a discharging fistula is always diagnostic of tissue necrosis.

As the pathologic process becomes more firmly established with each succeeding stage, the salvation of the tooth is more likely if treatment is begun early. It is an easy thing, by poorly conceived operative tactics, to cause the pathologic process to advance or even run its full course. Therefore, while the use of every known diagnostic aid may leave many important elements in doubt, every effort should be made to determine the exact pathologic condition before treatment is undertaken.

The Farragut.

THE MEDICINAL TREATMENT AND THE FILLING OF ROOT-CANALS*

By J. R. BLAYNEY, B.S., D.D.S., Chicago, Illinois

THE discussion of root-canal medication is extremely difficult without reference to the mechanical cleansing of the canal. All of my further remarks on this subject will be made upon the following premises: 1. All treatments are carried out in accordance with surgical technic. 2. Root-canal medication is second in importance to the thorough cleansing of the canal by mechanical means.

At the present time, root-canal therapy is divided into two schools, which may be called the antiseptic school and the aseptic school. The first group have used antiseptics of various strengths for the purpose of destroying the bacterial growth both within the canal and in the periapical tissue with little thought of the effect produced on the remaining vital tissue surrounding the root end; while the second group, recognizing the injurious effects most germicides have on vital tissues, use only the mildest of drugs along the surface of the canal.

In the treatment of a pulp-canal, we have two types of tissue to consider: (1) the dentin which is deprived of all its circulation following the removal or death of the pulp and is infected in cases of necrotic and gangrenous pulps, and (2) the periapical tissue which, in many cases of apical infection, is diseased, but still has sufficient circulation to maintain its vitality. The dead and infected tissue (dentin) is treated with mechanical and medicinal agents, but the vital soft tissue is repaired by the natural defensive processes of the body after the source of irritation has been removed. In former years, it was considered good practice to force drugs through the apical foramen into the soft tissue; whereas, today, owing to the study of the histopathology of such cases, we know definitely that drugs are to be kept within the tooth in order to give the circulatory fluids the greatest opportunity to effect repair.[1]

Dentistry has been passing through the stage of antiseptic surgery, a condition from which general surgery emerged some time ago. At that time, it was common for the general surgeons to use such antiseptics as phenol; whereas, today, he removes all of the diseased tissue under surgical technic and leaves the absorption and repair to the biologic forces of the patient. In selecting drugs to be used in the canal, we must be mindful of their effects on the vital apical tissues and select the more ideal antiseptic. While much has recently been said about new and ideal antiseptics, it is doubtful that we have one at the present time that will inhibit the growth of bacteria without irritation to the cells of the adjacent tissue. As a result of the war, several agents have been developed that approach the ideal.

*Read before the Section on Anatomy, Physiology, Materia Medica and Therapeutics at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

1. Blayney, J. R.: Root-Canal Therapy on a Biologic Basis, to be published.

Of these, the aqueous solutions that liberate free chlorin hold a prominent position.[2] I have, for some time, been using such a solution, which has given excellent results. This is an alkalinized solution containing sodium paratoluenesulphonchloramid, sodium hypochlorite and sodium chlorid. Paratoluenesulphonchloramid, or chloramin-T, contains not less than 11.5 per cent nor more than 13.0 per cent active chlorin. This solution should be preserved in amber bottles and protected from light and air. As it readily decomposes when in contact with steel, it should be carried into the canal with stellite pliers or a glass syringe.

A word concerning the action and use of chlorin-evolving solutions may be of benefit. Chlorin, in its free or nascent state, attacks the protein molecule of the bacteria by replacing its hydrogen atom or atoms. When sufficient chlorin action has taken place, antisepsis is secured within the root canal. Chlorin also has the property of neutralizing and condensing some of the gases of putrefaction, most noticably ammonia. The major portion of the chlorin liberated acts on water because of its affinity for hydrogen. The water molecule is destroyed, liberating free oxygen, which, in turn, oxidizes the products of bacteria and bacterial decomposition.

$$\begin{array}{l} \mathrm{Cl\ H} \\ \mathrm{Cl_2 + H_2O = O = 2\ HCl + O} \\ \mathrm{Cl\ H} \end{array}$$

2. Blayney, J. R., Hatton, E. H., Hall, E. M., and Rickert, U. G.: Report of Root-Canal Therapy Committee of Chicago Dental Society, Bull. Chicago Dent. Soc., June 18, 1926.

Care must be observed in the frequency of applying chlorin yielding solutions. It has been our practice to see these cases every twenty-four hours, especially when there is suppuration. The object being, in part, to relieve the pressure caused by the accumulation of pus and toxic edema and also to replenish the supply of chlorin, which has been readily consumed. Three treatments usually render the canal free from bacterial products, although the canal is frequently moist from the accumulation of lymph.

Heroic methods have been in vogue in the past for destroying the bacterial growth in the tissue beyond the apex. Today, it is considered better technic for the operator to confine all medicaments to the surface of the canal, leaving the defensive mechanism of the body unhampered to combat the inflammatory reaction in the periapical tissue. The use of methods directed toward sterilization of the periapical tissue does not conform to biologic law, and where such drastic procedures are required, surgical interference is indicated. When the source of the infection and irritation is eliminated, natural biologic forces usually bring about favorable regeneration. In the treatment of putrescent canals either with or without periapical disturbance, we have found that such drugs as beechwood creosote, aqueous solution of chlorin, equal parts beechwood creosote and 3 per cent tincture of iodin, and eugenol, applied to the dentinal surface of the canal, give very satisfactory results. The drugs should be the purest obtainable, as impurities are frequently the source of continued irritation. The purpose of therapeutic procedures is to establish and maintain aseptic conditions along the surface of

the canal and not to sterilize the soft tissue surrounding the root-end.

We would not ask Nature to resist chemical necrosis as well as infection. The sterilization of an infected root canal is not accomlished by drugs alone, but by a thorough mechanical removal of organic débris and softened dentin and by ventilation and drainage, combined with the judicious use of non-irritating antiseptics.[3]

Prinz[4] says that an agent to be used in the canal should be in accordance with the following rules:

1. It must be able to develop the highest degree of antiseptic power without doing harm to the periapical tissue.
2. It must maintain its activity at least twenty-four hours when sealed into the root canal.
3. It must not cause pain.
4. It must not discolor the tooth structure.

MEDICATION AFTER THE REMOVAL OF VITAL PULPS

Before amputating an inflamed or infected pulp, the excess amount of blood is removed by encouraging bleeding, a dressing carrying a mild antiseptic, such as an aqueous solution of chlorin or eugenol, is placed over the exposure, and the cavity is sealed without pressure for at least twenty-four hours. Several drugs have been popular for rendering the removal of the pulp painless to the patient. Probably the most common drug, at least in the past, was arsenic trioxid, while more recently the anesthetics have been constantly growing in favor. The use of protoplasmic poisons for the purpose of destroying the pulp should be discouraged. The study of the anatomy of the apical region clearly indicates that it is physically impossible to remove all the organic tissue within the apical canals. The tissue that is left in the apical portion of the main canal and all of its apical ramifications must be uninjured by drug action. Pressure anesthesia with cocain hydrochlorid, especially when the cocain is in a 5 per cent solution or over, may be responsible for retrogressive changes following pulp removal, as cocain, in such solution, is a protoplasmic poison. Block or infiltration anesthesia is to be preferred.

If the operative procedures are carried out under a surgically clean technic, we have no need for potent antiseptics, as all of the involved pulp tissue has been removed and the biologic forces effect the repair. Undoubtedly, much harm has been done to the surrounding soft tissue by the use of coagulating drugs. After pulp removal, the smallest possible quantity of eugenol is placed on a paper point that will not impinge on the remaining vital tissue and the tooth sealed for four or five days. It is not advisable to open the canal until sufficient time has elapsed to permit granulation tissue to form over the remaining stump. The use of irritating drugs will materially delay the process of healing, and frequently they are responsible for the collection of an edematous fluid in the canal. Root-canal therapy will advance as rapidly as we place our operative technic on a surgically clean basis, as we discontinue the application of caustic drugs to the periapical tissue.

ROOT-CANAL FILLING

The purpose of filling a root-canal is to seal hermetically the inner ends of the dentinal tubules and to annihilate completely the spaces in which fluids may collect and there serve as culture mediums. The ideal root filling should have the following qualifications:

3. Blayney, J. R.: Some Factors in Root-Canal Treatment, J.A.D.A., 11: 840 (Sept.) 1924.

4. Prinz, Hermann: Dent. Cosmos, 61: 954 (Oct.) 1919.

1. The filling material should approach closely the remaining vital stump without exerting pressure on the soft tissue. 2. It should completely fill and hermetically seal the canal from that point to the floor of the pulp chamber.[2]

The indications that the canal is ready to receive the filling are as follows:

1. The tooth should not be tender or sensitive to light percussion with a metal instrument.

2. On removal, the dressing that has been sealed in the canal must be dry, colorless and free from all putrescent odor. The absence of odor must not be understood to indicate that antisepsis has been secured.

3. The canal should be mechanically prepared to receive the root-filling; i. e., there should be a gradual tapering of the canal from the pulp chamber to the apical region.

4. The other teeth in the same quadrant should be in a safe condition.[2]

There are a number of methods for placing the filling material within the canals. It is of prime importance that we analyze our technic and make sure that we are conforming to biologic laws. The principle of an overfilling or encapsulating technic had for its purpose the sealing of the denuded apical cementum, and since these cases are not indicated for treatment today, the process of encapsulation is not needed. Curiously enough, the wave of underfilling is just as dangerous if in speaking of underfilling we refer to any kind or any amount of filling material within the canal. Carelessness in inserting the filling material will perpetuate many of the troubles of the past.

TECHNIC

When the conditions previously stated exist, the canal should immediately be filled. The size of the apical portion of the canal may be determined by the size of the instrument that will pass to it or by using a paper point the tip end of which is removed until the cone will just pass to the foramen or site of amputation.

The length of the tooth may be determined accurately by the aid of the roentgen ray. Measuring wires of assorted sizes should be kept in readiness, as large a wire as the canal will permit being used. The occlusal end of the wire should be flush with some landmark on the occlusal surface, but it should not be covered by the sealing agent. The radiogram does not always give a true length of the root, but by comparing the length of the measuring wire with the length of the shadow cast by the wire, an accurate estimate can be made as to the correct length of the tooth. The following formula will illustrate. The length of the wire is to the length of the shadow of the wire as the length of the tooth is to the shadow cast by the tooth.

This measurement control should be established early in the process of treatment so as to avoid all possibility of mechanical trauma to the apical tissue. Root canals should be filled by measurement and not by pain as manifested by the patient.

A root-canal plugger of a size that will pass well into the root canal is selected, and by comparison with the wire measurement, a bend is made in the plugger so that when this bend is flush with the occlusal landmark of the tooth, the point of the instrument will be 3 or 4 mm. short of the root

end. A section of guttapercha cone is now selected whose cross-section is the same as the estimated diameter of the apical portion of the canal and is long enough, when it is attached to the plugger, that the distance from the end of the cone to the bend in the plugger is equal to the estimated length of the tooth. The plugger, with a selected piece of cone attached, is carefully placed on the sterile operating tray ready for immediate use. In case of an accessible canal, a paper point charged with eucalyptol is inserted in order to moisten the dentinal surface. It is never advisable to have an excess of fluid in the canal. The plugger carrying the selected cone is now placed in the canal the required depth and gently packed. The plugger should be turned slowly about one quarter turn to the right and to the left, in order to insure its detachment from the guttapercha. The remainder of the canal is filled by packing short sections of cones that have been slightly warmed in the open flame. The diameter of the plugger and cone should be increased as rapidly as the canal will accommodate the larger sizes. In packing the sections of guttapercha cones, considerable pressure should be used in order to obtain a dense, homogeneous mass of filling material within the canal. I have had better success in obtaining a root filling that checks with the ideal requirement by following this technic rather than by attempting to fill the canal by using a full length guttapercha cone. In filling the very small and inaccessible canals after the application of eucalyptol, a few drops of chloropercha are pumped well into the accessible portion of the canal and then the first piece of guttapercha is placed and packed as previously mentioned.

In canals with an open foramen, the use of chloropercha is liable to result in overfilling, which is not to be desired. Should the first section of the cone inserted be too small to occlude the canal completely at the apex, an overfilling is likely to be the result. Care should be exercised to prevent this happening. While it is not possible to avoid such a condition entirely, it can be reduced to the minimum by the use of the measurement control, as previously described. For an ideal root filling, it is not sufficient that the radiogram show the filling material extending very nearly to the root end, but the microscope must show the filling material in close approximation to the canal wall so as to occlude completely the full diameter of the canal. In sectioning many teeth with well filled canals, as revealed by the radiogram, it is not uncommon to find, especially in the apical portion of the root, that the guttapercha only partially fills the canal lumen. The remaining space offers opportunity for the collection of exudates, which favor the growth of micro-organisms.

In reviewing a large number of case histories for several years back, we have found that those cases in which the full diameter of the canals were filled to within a short distance of the foramen give the best results. Accurate clinical and radiographic records should be kept of all cases treated so that each operator may have the opportunity to study their progress and check the results obtained with the methods employed. It is only through the study of large numbers of cases with accurate records that we can hope to standardize the basic principles of root-canal therapy.

ROOT-CANAL FILLING MATERIALS*

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THE pulpless tooth question resolves into two great problems: (1) that of aseptically removing vital pulps and antiseptically treating putrescent material preparatory to the placement of fillings; and (2) the selection and adaptation of filling materials which effectively seal the dentinal tubules at their pulpal orifices and obliterate the pulp canal that there may be no passage of fluid or bacteria from the canal or tubules to the circulating fluids of the body.

While at first it might seem to be merely a problem of securing a filling material which is compatible with living tissues where it comes into immediate contact with them at the apical foramina, the greatest difficulty is really encountered in the preparation of the pulp canal to gain suitable access and form for the introduction and adaptation of materials which are to fill them.

The necessity of placing a watertight filling was overlooked by most of the pioneers, no doubt because bacteriology was little understood. Chronic abscesses which developed in the wake of those early attempts to fill with gold foil, amalgam, copper points and cements were the natural result to be expected from unsealed apical foramina.

Serous exudate will accumulate in any portion of unfilled canal, and, being diverted from normal circulatory channels, undergoes decomposition, and sooner or later invites bacterial colonies to form chronic foci of infection. Most canals are branched at the apices of the roots, forming multiple channels which can be filled only by very plastic materials.

It is difficult to conceive of a dehydrated pulp canal at the point where it ends in live tissue. Seepage is almost always present and prevents the hermetic sealing of many canals. Of course, if sufficient time elapses after pulpectomy, the live stump will heal over with a scar membrane, which, if uninjured, will permit of almost complete drying of canals to their apices.

While it is not within the province of this paper to consider the preparation of canals for the reception of fillings, their shape, access, pathologic state and comparative dryness all have much to do with the selection and the ultimate success of canal fillings. For example, the inverted funnel shaped, wide open, seeping or bleeding apical foramina, in many first permanent molars at 9 years of age, present problems all their own which are quite different from the problems presented by the single rooted tooth in the patient 60 years of age. In the latter case, the canals are distinctly conical in form, their apical foramina being so small that seepage is negligible, and their converging walls assist in the condensation of the filling material to the very apex.

While many dentists are reluctant to confess their occasional failures in the treatment and filling of pulp canals, and although the majority of fillings

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endure without producing decalcification in the periapical tissues, there still exists too high a percentage of teeth containing pulp-canal fillings which do show tissue disturbances and which either render their retention a questionable procedure or condemn the teeth to extraction. It is our hope that a more intelligent selection of filling materials will materially reduce the number of failures.

The very nature of the work of inserting pulp canal fillings frequently renders the making of second or third attempts necessary. This calls for the employment of plastic materials which can be removed readily at any time within a week or two after their insertion in case the radiogram indicates that the filling is unsatisfactory.

Pulp-canal filling material must be nonirritating to the soft tissues; for if it irritates, it will provoke inflammatory reaction and tissue destruction with the formation of a well or pocket, about the apex, containing fluid. Such cavities may later become cystic, but, more frequently, they determine the sites for chronic infected granulomas. Fillings which irritate tissues as do unpolished amalgam and cement, even though they may possess many other desirable qualities, should not be employed in canals in which they are likely to be forced as granular, irritating masses beyond the root apices into the periapical tissues.

Histologists have agreed that the proper site for severing a pulp is just within the apical foramen at the dentinocemental junction. This becomes a mechanical impossibility in those teeth having multiple foramina or small tortuous canals. Here chemical aid is necessary for their preparation to receive fillings; and highly plastic or semifluid materials must be used to fill them.

Excessive reaming at the apex usually destroys the peridental attachment of some of the soft tissues and renders difficult the placement of any filling. Overinstrumentation is extremely likely to cause failure from overfilling. For the same reason, it is hazardous to attempt to fill canals in undeveloped roots. It is important that we select broaches that are too large to be carried through the apical constriction, thereby avoiding wide tunneling of the apex to such a degree that there is nothing left to condense the filling against.

A routine practice of incorporating antiseptics in filling material is not recommended because of their irritant action. If asepsis is maintained during the treatment, antiseptics are contraindicated, for they are not tolerated well by living tissues. It would seem that here, as in other fields of dentistry, no one filling material is universally applicable. Resin varnish is a very adhesive and effective sealing medium for closing dentinal tubules and for preventing apical seepage of serum alongside guttapercha cones. Chloropercha and eucapercha rank next, but shrink badly in large canals unless the bulk is almost entirely displaced by guttapercha cones introduced the full length of the canals.

Silver reduction exerts a bactericidal influence for a time, desirable in cases in which putrescent material is harbored in the dentinal tubules, but the discoloration produced is a serious objection to its universal application.

Metallic substances, such as gold, silver, copper, lead and amalgams, usually fail because they either cannot be adapted to the canals, or, in their

placement, they are carried beyond the apex, where they produce irritation. Dental cements are hard to adapt, and, when once crystallized, are so difficult to remove that it renders refilling incompletely filled canals almost beyond question. However, the adhesion of cement to the walls of the canal, together with the rather impervious qualities, makes it a favorite of some very skilful operators.

Modified cements have their advocates. They usually are made to set in the presence of a moderate amount of moisture, but in canals having large foramina, their crystallization is often prevented by excess moisture, and the fillings fail. Some occasionally absorb, especially when forced beyond the apex in quantities, and this very quality renders the permanency of the fillings uncertain.

Numerous gums and resins have been used with varying degrees of success depending on the exactness with which the material is adapted to the dry canals. *Pinus sylvestris* or "fiddle bow resin" is usually selected. It is very readily soluble in either alcohol or chloroform, forming a varnish which sets immediately on evaporation of the solvent. Its chloroform solution is not miscible with water and gums up when water comes in contact with it; precluding its use in canals containing moisture. In alcoholic solution, it will absorb more than 30 per cent of water without serious injury. This permits Buckley's solution to enter moist dentinal tubules and to adhere to moist pulp canal walls, producing a water-tight joint even when absolute dryness is unobtainable.

Metallic silver, deposited according to Dr. Howe's technic, has a desirable temporary bactericidal effect, and, in accessible canals, undoubtedly seals the dentinal tubules. While it has not proved to be the panacea which its early enthusiasts claimed it to be, its place seems to be in the fine tortuous canals of posterior teeth that have harbored putrescent material. Whenever possible, it should be fortified with guttapercha after a generous deposit of silver has been made.

Guttapercha in various forms and combinations has, of all materials, best withstood the test of time. None of its solutions are water soluble, and none will adhere to moist canals; therefore, they will only hermetically seal dehydrated canals. The solutions carried within fine tortuous canals and cones or segments of cones adapted to the larger canals and condensed with suitable pluggers seem to be ideal. It can be readily removed if occasion demands, and when forced into the tissues beyond the apices, it is least irritating of all pulp-canal filling materials.

"Dentinoid" (Buckley) consists of a calcium phosphate base with a resin binder to be dissolved in alcohol. Recent studies show that it is quite compatible with tissues at the apices. If properly condensed, it forms a solid unshrinking impervious filling which adheres to the walls of pulp canals, and effectively seals the openings of the dentinal tubules. It is slightly more radiopaque than dentin, but while it is clearly visible in radiograms of large canals, it is difficult to detect in the radiograms of teeth having fine canals.

Callahan's chloroform rosin solution, when used as a lubricant for guttapercha cones, likewise has the property of sealing tubules, and by its solvent effect on the guttapercha cones, assists in molding the guttapercha to conform

to the shape of the canals. It will not enter moist canals and it is not radiopaque; therefore roentgen-ray evidence of perfect adaptation is lacking.

Large canals can be filled well by the employment of guttapercha pellets obtained by cutting pulp canal cones into segments, as recommended by Dr. Gethro. The segments are selected to fit the canal after the diameter of the latter has been determined by measuring with a graduated set of pluggers. Segments are fixed on suitable plugger points dipped in chloroform and immediately carried to place and condensed individually until the canal is full. It is well to fill the apical third only by this method before radiographing to determine whether the apical segment has been properly placed, then to complete the filling later at the operator's convenience. Medium sized and fine canals are best filled by being flooded thoroughly with a lubricating solution of dentinoid, Callahan's solution, eucapercha or chloropercha, the bulk of which is displaced by the insertion of full length guttapercha cones.

In clinics at which records are kept and systematic radiographic checkup examinations are conducted at regular intervals, the indications are that, of all teeth treated, and with various types of canal fillings, about 60 per cent remain radiographically satisfactory. Of the ones with complete canal fillings, about 80 per cent remain satisfactory. Results are best in canals which are accessible to their apices; in other words, canals in which the fillings can be properly inserted and the apical foramina sealed.

With the present method of determining the success or failure of pulp-canal treatment, the employment of filling materials that are radiopaque is imperative. This demands the incorporation of guttapercha, or metallic substances, with the resinous preparations.

Small canals previously infected are best coated with reduced silver, and then filled by Callahan's method of resin varnish and guttapercha cones.

It is hoped that time will bring exact methods of determining successful fillings, but, at present, the radiogram with its deceptions and limitations must be relied on to disclose the character of fillings and the degree of tissue tolerance.

Unfortunately, some of the filling materials which promise most are radiolucent, and others not so good are beautifully radiopaque. The employment of Callahan's solution, for example, has cast the shadow of scorn on many excellent fillings, while the use of guttapercha cones, loosely placed in canals and of no earthly use, has been frequently misinterpreted as showing excellent judgment. This factor, while apparently of little significance, should be taken seriously when we consider that the men who are later to check up on the patient's oral condition are often unfamiliar with the character of filling material used.

CONCLUSION

The selection of pulp canal filling materials today is just as satisfactory as the selection of those used in the coronal portions of the teeth, but their choice must be made to fit the cases with as much care as we display in selecting any other filling materials if we are to secure the best results. The time has come when greater care should be taken in diag-

nosis, not only from the standpoint of the patient's systemic condition, but in order that we may determine the accessibility and form of pulp canals. Then the medicaments and filling materials may be intelligently chosen to meet the individual condition of each case. No one should attempt the filling of all pulp canals, but in the light of present knowledge should select for treatment only those with small apical foramina and canals which are accessible and are easily negotiated with instruments to their apices.

COPPER AMALGAM AS A ROOT FILLING MATERIAL*

By F. C. HUSBAND, D.D.S., Toronto, Canada

THE antiseptic properties of copper amalgam have been known and experimentally attested to again and again for many decades. Miller made experiments to determine the antiseptic properties, if any, of filling materials. He not only found that copper amalgam, freshly prepared and old fillings, had antiseptic properties, but he also found what was more significant, that dentin from extracted teeth which had been filled with copper amalgam was not only sterile but had antiseptic properties also. Simms repeated the experiments of Miller, and found that copper amalgam and oxychlorid of zinc had definite antiseptic properties for some distance about them. Black says:

> This amalgam has so many good qualities that many abandon it with much regret. I think it is generally acknowledged that copper amalgam fillings retain good margins, when they are once made perfect, better or more perfectly than any other filling material. Within the limits of its strength, it is as rigid as hardened steel. It does not contract but exhibits very slight expansion on setting.

Black believed that its inhibition of caries was largely due to its perfect fitting of the cavity walls. Kirk says: "Its preservative qualities render it a valuable constituent in teeth of low grade structure." Foster Flagg says: "I regard copper as a most valuable constituent of any amalgam." Weagent says that copper amalgam acts as a preservative of the dentin by permeating the tubules with an antiseptic solution. Fraser[1] repeated the experiments of Miller, Simms, Black, Kirk and others and found that copper amalgam had antiseptic properties of a permanent character, and further that it retained its antiseptic properties after being transferred to a fresh medium every two weeks for a period of five years. Because of this permanent antiseptic property and the fact that clinical experience over many years had shown that it had no irritating properties in contact with vital tissues, it was suggested that "it might be used with decided advantage where discoloration of the tooth is not a factor, as a temporary filling, or in root canals, in cavities below the gum line and when it could be covered on the exposed surface by another filling material."[1]

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1. Fraser, C. Jane: Dominion Dent. J., 37: 1 (Jan.) 1925.

Dr. Fitch[2] suggested the use of silver amalgam as a root canal filling in preference to gold foil or cotton wool, which were in common use. He evidently wished to be cautious in the matter, because he says "The writer does not wish to be understood as recommending it for this purpose but would suggest some points of comparison."

It is quite apparent, from dental literature, that filling root canals with either silver or copper amalgam never became a general practice, since no textbook mentions it as a method to be followed. Copper amalgam was abandoned as a filling material chiefly because of its discoloration. As Black says, "Copper amalgam has many desirable properties which should not be lost sight of and if the technique suggested below is followed, what seemed to be its undesirable properties can be utilized to preserve and save many otherwise doomed teeth and prevent infected areas about the tooth root end."

TECHNIC OF ROOT CANAL FILLING

The canal is prepared as for the Coolidge sectional method. Reasonable enlargement of the canal is necessary with choke bore or shoulder at the apical end. This shoulder preparation, as has been pointed out in connection with the Coolidge method for guttapercha, enables the operator to place the first section of the filling more definitely. Reamers in the engine should be used with the greatest care, if at all. Hand reamers are much safer.

A radiogram of the root with a diagnostic wire in place should first be made to determine exactly the length of the canal.

As large a root canal plugger as will pass to the end of the canal without binding should be chosen. The end of this plugger is dressed off with a cuttle fish disk in the engine so that it is flat and at right angles to the shaft of the plugger.

A shoulder is bent on the plugger so that the shoulder will rest on a given or chosen edge of the cavity margin when the point of the plugger is at the end of the canal.

This shoulder indicates that the plugger is reaching to the end of the canal and no farther.

The copper is mixed quite smoothly by adding or expressing mercury as required. The mix must not be "sloppy."

A small piece is carried to the mouth of the canal with pliers or an amalgam carrier, and gently guided into the mouth of the canal with a suitable plugger or small pledget of cotton in pliers, any suggestion of packing being avoided. A plugger, already selected with a shoulder as above described, is held with a very delicate grasp between thumb and finger, and is passed through the amalgam and, with one continued motion, right to the end of the canal, or until the shoulder engages the cavity margin at the point selected. This process is repeated several times carefully, until it is observed from the shoulder on the plugger that the amalgam is built up about 1 mm. at the apical end of the canal.

Gentle tamping will adapt the amalgam and condense it. The process is repeated, the amalgam being built up 1 mm. at a time until the desired amount—from 3 to 5 mm.—has been inserted.

The surplus amalgam is removed with barbed broach and the remainder

2. Fitch: American System of Dentistry, 1887.

of the canal filled with a combination of oxychlorid cement and guttapercha as follows: Having chosen a suitable guttapercha point, as large a one as will pass freely into the canal, we fill the rest of the canal full of a rather soft mix of oxychlorid of zinc cement and press the guttapercha point through it to the full depth. The surplus is wiped off with a hot ball burnisher, and, with a suitable plugger, warmed guttapercha is gently pressed into the cement. This will bring to the surface globules of mercury which have escaped the barbed broach. These should be removed from the tooth.

In order to prevent discoloration of the crown or visible neck of the tooth, the root filling should be removed to a safe depth (from 4 to 5 mm.) rootwise of the gum margin with a burr in the engine, and the walls of this portion of the canal made perfectly clean. The portion of the root filling thus removed is replaced with oxychlorid of zinc cement.

The placing of the guttapercha cone in a portion of the canal, as described, makes it possible to gain easy access to the canal for the insertion of a dowel, as in the construction of a crown, should that be necessary at a later date.

Radiograms should be taken immediately after the copper amalgam is inserted and before the cement and guttapercha are inserted, to check up the work and to satisfy the operator that it has been placed where he wishes it to be. In the event that he has failed to get it to the end of the canal, it can easily be removed because it is very slow in setting, taking hours to harden. Even after it is set, it is possible to remove it with a hot probe.

Copper amalgam can be successfully placed in any root canal in which guttapercha can be placed and has a decided advantage over it because of its proven germicidal qualities of a permanent nature.

Should any be pressed beyond the apical opening, it will be found to be nonirritating, except in a mechanical way, on account of pressure. This is only temporary, however.

Copper amalgam has been successfully used for a number of years as a root-end capping after root resection, but it would seem a simpler and much more effective method to fill the apical portion from the coronal end, provided the canal could be opened.

On account of the germicidal influence extending some distance on all sides of copper amalgam, it would seem permissible to place the amalgam 0.5 mm. or more short of the apical opening rather than press it through. Such investigators as Clyde Davis of Nebraska have shown, chiefly in devitalization cases, that the peridental membrane closes over the apical opening and even deposits lime salts in the opening, thus effectively sealing it. Any operation, therefore, that would permit of this physiologic repair would seem to be acceptable.

The vulnerable portion of a root canal is at the apical end because of the difficulty of closing the foramen or foramina.

Crownwise of these, the junction of the dentin and cementum—dentinocemental junction—is, as it were, a fire wall, impenetrable and forming a barrier to the ingress or egress of organisms. Therefore, at least one of three things, it would seem, must be accomplished in dealing with these foramina

in order to make a root canal operation a success:

1. Induce, if possible, physiologic closure of these foramina. (Davis.)
2. Mechanically obliterate (or fill) them.
3. Maintain asepsis of a permanent character in that area without causing irritation to the periapical tissues.

Briefly consider these in order:

1. *Physiologic Repair.* — Copper amalgam placed close to the end of the canal, after careful preparation, will permit and not hinder this repair because of its germicidal and nonirritating properties.

2. *Mechanical Obliteration.*—This is well nigh physically impossible, except in roots with a single foramen. A solution of rosin and guttapercha in chloroform cannot be relied on since the solvent becomes disseminated and leaves but a fraction of the original bulk in the spaces that it was supposed to fill. Neither can precipitated silver or any other precipitated material mechanically obliterate. The deposit, at best, is a porous mass.

3. *Maintenance of Asepsis.*—Since physiologic repair is uncertain as is also mechanical obliteration, various medicated filling materials have been depended on. The main difficulty encountered with these is that they sooner or later lose their antiseptic properties and themselves become infected together with the surrounding tissues. Not until Fraser's work in the University of Toronto on "A Study of the Efficiency of Dental Fillings" was the fact demonstrated that, of all filling materials, copper amalgam alone possessed permanent germicidal value.

This fact, together with the findings of Miller, quoted at the beginning of this paper, viz., that dentin from extracted teeth which had been filled with copper amalgam was not only sterile but had antiseptic properties also, placed copper amalgam in a very favorable light as an ideal material to use in that vulnerable portion of the root canal—the apical end—provided it could be successfully inserted.

It is not only very adaptable physically and, what is important, impregnates the surrounding tissues with its benign antiseptic properties making the surrounding dentin thus impregnated actively germicidal, but, above all, it maintains this condition permanently. Nature, then, must be relied on to regenerate the periapical tissues. Clinical results have amply verified this.

1. Teeth with large areas were kept under treatment as long as eighteen months, or until the areas cleared up, and were then filled, and have remained clear.

2. Teeth with large areas, some with sinuses, were given short treatment during the time of canal preparation and cleared up *after* being filled with copper amalgam.

3. Teeth that had remained tender for months under bland medical treatment lost their tenderness in from a few hours to a few days after the insertion of a copper-amalgam root filling.

4. Copper amalgam carefully placed over punctures in roots or in the floor of the pulp chamber gives satisfactory results.

Permit me, in closing, to emphasize the necessity for the most painstaking care in the preparation of the canal, in the insertion of the filling and in the checking up of your work, as it progresses, with the radiogram.

THE PRESENT STATUS OF DENTISTRY IN INDIA*

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FROM the title of my paper, some here assembled may hope to learn something new regarding advancement of the profession of dentistry in India, but let me be honest and say that this hope will not be realized.

As a representative from India, I come to the Congress bringing with me no message of hope. Instead I come in search of encouragement and suggestions from you.

I bring with me the silent message of the heart of the immense multitudes of people of India, with an appeal to the entire dental profession in general in the United States to guide us in some humane way to relieve the dental distress of suffering humanity in India.

The very fact that from my vast and populous country of India, having the population of 350,000,000 people, there comes but one representative to this world's dental congress, speaks for itself.

Taking into consideration the vast population of India, naturally some of my learned brethren assembled here may suppose that there must be at least fifty dental schools and about as many free dental hospitals and infirmaries, with a dental profession of about 50,000 members.

Before I give the different reasons for the deplorable status of dentistry in India, let me present a tabulation showing at a glance the status of India in the dental field.

From the table it can be readily seen how poorly India is equipped as regards dental relief. But if this were not enough misery, of the 5,000 dentists in the whole of India, 95 per cent are unqualified men—men, who, though supposed to relieve suffering humanity, are really augmenting that suffering beyond conjecture.

Likewise, as all other nations have their ideals and ambitions as regards research and inventions in the science of dentistry, India is not devoid of high impulses and ambitions; but many adverse conditions—the attitude of its people, its poverty, the scarcity of professional men, its medical profession, its religious superstitions and, lastly but not the least important, its government, are conjointly responsible for the dormant state of India as regards dentistry.

In the whole of India, there is only one privately owned and conducted dental training institution, neither aided by the government nor recognized by or affiliated with any government university, and that is the Calcutta Dental College, whose principal, Dr. R. Ahmed, also left India to attend this Congress, but unfortunately, owing to

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ill-health, was compelled to return home to India from England.

In the whole of India, among its many municipalities or city councils, only one municipality, the Bombay Municipality, has opened a school dental clinic for the benefit of the children of the primary and secondary municipal schools of Bombay.

For three successive years, I have introduced to the municipal corporation a bill for establishing school dental clinics in the municipal schools of Bombay but it was thrown out each year. But undismayed by the failure, I have made a further and greater effort to draw the attention of all authorities to the vital importance of the care of the school children in the municipal schools of Bombay and to emphasize the responsibilities on the part of the authorities in this regard; and, at last, in the fourth year, the bill was carried by a majority and passed.

It would surprise you to learn that, for a total number of 300 municipal schools, with a total of 32,000 children, there has been only one dental officer appointed. It appears ridiculous, but even that is a fortunate state of affairs for the children considering the conditions under which the bill was introduced.

In the whole of India, even in the principal cities such as Bombay, Calcutta and Madras, each with the average population of 1,500,000 people, we cannot boast a single governmental dental college, neither can we boast a free dental hospital or an infirmary which will take care of the poor people of India as they should be, as regards their dental afflictions, except that the general medical hospitals are offering a very little offhand and very poor dental service to the poor and needy people of India.

Such is the deplorable condition of the dental situation in India at the present time. Naturally, the question arises, "Who is to be blamed and what are the responsible factors?"

The main cause, the most vital cause, of the deplorable dental conditions in India, is the total indifference of the government toward the enactment of proper dental legislation, the opening of dental colleges and the establishing

PROPORTION OF DENTISTS TO POPULATION IN INDIA AS COMPARED WITH OTHER COUNTRIES

Country	Population	Total Number of Dentists	Number of People to Each Dentist
U. S. A.	110,000,000	50,000	2,200
Norway	2,700,000	750	3,600
Great Britain	46,800,000	13,000	3,654
France	40,000,000	7,250	5,517
Switzerland	4,000,000	750	5,666
Sweden	6,000,000	875	6,857
Argentine	9,000,000	1,200	7,500
Germany	63,000,000	8,100	7,777
Austria	6,500,000	750	8,666
Holland	7,000,000	650	10,000
Russia	14,000,000	1,100	12,727
Italy	40,000,000	2,800	14,285
Roumania	18,000,000	1,200	15,000
India	350,000,000	5,000	70,000

of free dental clinics and hospitals in India.

It is not within the powers of individuals in the profession to relieve such deplorable conditions among the vast multitudes of people. It is the wholehearted and solid support from the government that is needed to enable us to do even a little in dental propaganda work, to eliminate even a small percentage of the dental misery among the vast multitudes of India. The government of India has not yet considered it worth while to establish even one dental college in each presidency. There are several up-to-date governmental medical colleges in India, but there is not a single governmental dental school to offer dental education to India's children. That such a condition exists after 150 years of British rule is a sad commentary on the progressive claims regarding British rule in India.

Unless, and until, the British Government will make a solid effort toward the enactment of dental legislation, and along with it open even one dental college in each presidency and establish free dental hospitals and clinics for poor India, there is little hope that India will ever be relieved of its deplorable dental conditions.

India desires and craves the establishment of government dental colleges, free dental hospitals and infirmaries and school dental clinics all over the vast country, not with standards exactly similar but about the same as of those established by the county councils of Great Britain.

The next cause of the deplorable dental conditions is the total lack of dental education among the vast multitudes of the populace and the apathy of the people in general. Adhering to the old foolish ways of taking care of the teeth, which always amounted to next to nothing, coupled with some of the orthodox religious ways and customs among the different castes and ranks of India, people of India in general, with few exceptions, present the most deplorable state as regards the teeth—never cared for, never attended to and never understood. The harmful and filthy habit of betel nut and pan chewing is also largely responsible for increasing the percentages of dental caries and pyorrhea among the vast multitudes of Mohammedans and Hindoos of India. But as this habit of pan chewing dates back hundreds of years, it would be a real task for the dental hygienist to eliminate it.

The Purdah system, i. e., the seclusion of women, is another and equally bad factor in the dental condition of multitudes of women in India. The teeth of these women are never attended, for, being in Purdah or seclusion, they cannot be seen by male dentists. There are only about six women dentists in India.

The general population of India is very poor. Of the 350,000,000 of people, nearly half live on one meal a day, and even that meal is very poor in food value. The Western people do not really know what bitter trials we Eastern people are undergoing owing to the lack of necessities of life.

There are, on an average, about 80 per cent of the people of India suffering from pyorrhea and other dental conditions, but of this number, there are only about 10 per cent who can afford dental treatment.

In India, there are quite a few millionaires who have their millions

lying idle, not knowing what use to make of the money, but if these same people were approached with an appeal for any help toward establishing a free dental hospital or a free dental clinic, they would refuse. No aid has been rendered by any of these millionaires up to the present time, according to my knowledge, although many appeals have been made by me and by others.

What is the reason of such total indifference? It is simply the result of the total ignorance of such people as regards the great good that could be done if such charitable dental hospitals and clinics were opened in India. The apathy of the people toward such a needed enterprise is marked, owing to the indifference of the government itself.

The last, but not the least, cause for the deplorable dental conditions of India is the situation as regards the medical and dental professional men conjointly in India. As shown in the table, for the vast population of India, there are only 5,000 dentists, including the 95 per cent of unqualified quacks. The number of qualified men is nowhere comparable to the number actually required in India. And even among these few, there is not a properly constituted association nor mutual cooperation in the advancement of the profession. In the total absence of any dental legislation, the profession is flooded with 95 per cent of unqualified dentists, strictly speaking not worthy of being termed dentists. Any man, however worthless he may be, with even a superficial dental knowledge, can easily style himself a dentist and start practice in the same way as a duly qualified dental surgeon. This class of men are doing more destructive work in the mouth than conservative work, if they do any at all. They are doing more harm in India than any other factor. The mass of the populace in India are so miserably ignorant that they do not understand the difference between the two classes of dentists.

Furthermore, the medical profession plays an important part in bringing about the deplorable dental condition in India, mainly by meddling with the dental work and also by encouraging the unqualified dentists by working in conjunction with them.

It can be thus seen that there is not even one factor in the situation that is favorable. Deplorable and only deplorable dental conditions will for a long time exist in India under the present situation unless a God-sent hand relieves India.

Such is the condition of the barge of dentistry in India, drifting without a compass in midocean, without an able skipper or a navigator, and with an unorderly, undisciplined crew, every minute enveloped in the powerful waves of destiny.

I have tried to explain the present status of dentistry in India, and it is on behalf of the entire ethical dental profession in India that I appeal to the dental profession in America. Guide us, help us and show us the way out of these conditions, to relieve the vast multitudes of suffering humanity in India.

May the hearts of men be moved, and may there be some attention paid to poor India, is my prayer!

MILITARY DENTAL SURGERY IN CANADA*

By WALTER G. THOMPSON, D.D.S., Hamilton, Canada

THE formation of an army dental corps as a distinct unit in military organization was an innovation made, during the Great War, in the Canadian Expeditionary Forces. As pioneers, the Canadian officers had no established rules to follow, but had to adopt methods of procedure as they went along. Three things were kept in mind, during and after the cessation of the war: (1) the general care of the teeth of the troops; (2) the protection of the public purse against improper claims for pensions, and the remedying of such things, which, if not attended to, would result in pensionable conditions; (3) the contribution, by facial surgery, to the reestablishment of disabled or disfigured soldiers in civil life.

It was seen very early in the organization of the Canadian Expeditionary Force that a separate and distinct dental corps was an absolute necessity. Dental work could be effectively carried out only by a unit with full authority to map out its own procedure and carry out, unhampered, its own course of action.

This was strenuously opposed by medical officers; but, with the approval of Maj. Gen. S. C. Mewburn, the minister of militia, the corps was formed, and it was so entirely successful that, in the event of another war, the Canadian Army Dental Corps will be immediately mobilized.

I will deal briefly, with the dental treatment of discharged soldiers in Canada.

The dental examination for discharge was made at the concentration camps in England. There was filled out for each soldier a card entitled "Dental Examination on Discharge." This gave the man's regimental number, date of enlistment, theater of service, place where he had received previous dental treatment, and particulars, if any, of the treatment he was to receive. The examining dental officer signed this, and a blank was provided to be filled in by the dental officer giving the treatment prescribed. If this treatment could not be completed before discharge, he received a "Dental Certificate on Discharge," addressed to the officer in charge of dental services at the point where the treatment was to be given. This certificate had to be presented within two months after discharge.

Now, at the end of the long war, the soldiers were so anxious to get home that many a man tried to avoid dental treatment that would delay him; but once in Canada, he took a different

*The papers of Drs. Thompson, Rhoades, Harrison and Messner make up a symposium on "Military Dental Surgery."

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position. While in the army, he had learned the value of dental attention, and he wished to reenter civil life with his teeth in good condition.

Hence, a further examination was given to a large number of men after their return to Canada, and treatment was extended after date of discharge. Also, when disease or disability after discharge could be traced to causes which owed their existence to the war, it has always been the policy of the government to provide treatment. This prevents any feeling of bitterness among returned men. It also prevents, in many cases, a condition of health in which a man would be pensionable.

About two years after cessation of the war, the army dental corps was demobilized, and their work was taken over by the "Discharged Soldiers Civil Reestablishment," under a director of dental services. Under his direction, there are dental officers in various hospitals.

I should like to mention the valuable assistance rendered the army dental corps by the voluntary women's auxiliary. Anything which could contribute to the efficiency of the corps, not furnished by the government, was supplied by them, and the happiness and comfort of men and officers was greatly increased by their efforts.

The great lesson that we Canadian dentists learned during the war was that, for efficient care of the dental work of troops, there must be a separate army dental corps, commanded by its own director-in-chief.

Fight for that, as we did in Canada, and you will be doing great service to your profession, your troops and your country.

THE DENTAL SERVICE OF THE ARMY OF THE UNITED STATES*

By R. H. RHOADES, D.D.S., Washington, D. C.

I HAVE chosen simply to give an outline of the creation of the dental service as a special professional service in our Army, its growth, the present dental service, and War Department plans and accomplishments in providing expansions to meet a national emergency.

Prior to 1901, the only dental service available in our Army was rendered by medical officers, hospital stewards and enlisted men of the Hospital Corps. It consisted mostly of extractions.

A quarter of a century ago this year, Congress authorized a dental service to be rendered by licensed dentists. Our country had just passed through the Spanish-American War and was still engaged with hostilities in the Philippines.

The necessity for such a service being very acute in the Army, both at home and abroad, the Surgeon General,

*Read before the Section on Military Surgery at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

with the approval of the Secretary of War, was authorized to employ under contract thirty dental surgeons who should be graduates of standard medical or dental colleges. This number was increased to thirty-one in 1907.

In 1911, a dental corps was created and its official status authorized. Authorization was also granted to increase the number to one dentist per thousand of the actual enlisted strength of the Army, but not to exceed sixty dental officers in all. In 1917, it was provided that there be one dental officer per thousand of the total strength of the Army, without further limitations.

Even this increase proved inadequate to meet the requirements, and, in 1918, the United States being again engaged in war, the President, using his war powers, authorized further increase, which would have provided one dental officer for each 500 men of the Army. The Armistice being signed, this authorization was not fully carried out, and, through demobilization, the strength of the Dental Corps reverted to the legislative authorization of one dental officer per thousand of Army personnel.

Under the Act of June 30, 1922, the strength of the Dental Corps, Regular Army, was fixed at 158 dental officers.

The Dental Corps of our Army is a part of the Medical Department. It consists of commissioned officers of the same grades, who are distributed among such grades, as are officers of the Medical Corps.

Matters relating to the dental service as a whole are administered by the Surgeon General with the advice and assistance of a senior dental officer selected by him from among the officers of the Dental Corps, Regular Army. In a corps area, department, or other command, matters relating to the dental service are similarly administered by the surgeon with the advice and assistance of a dental officer.

The dental assistant to the Surgeon General is assigned to duty in his office as chief of the dental division and is held responsible by that officer for the progressive development of and efficiency in the dental service, both in peace and for war.

The responsibility of the dental assistant to the surgeon of each command is very similar to that of the dental assistant to the Surgeon General so far as they pertain.

The duties of dental officers are ordinarily confined to the prevention and treatment of oral diseases and deficiencies, but they are eligible for employment on such other duties required of commissioned officers as the needs of the service may demand and their training and experience warrant.

Graduates of recognized dental colleges, through competitive examinations, enter the Dental Corps as first lieutenants. Promotion is based upon years of service in grade and is subject to examination. The service required for promotion is: after three years, to captain; twelve years, to major; twenty years, to lieutenant colonel, and twenty-six years, to colonel. Of the 158 dental officers now authorized, four are colonels, eleven lieutenant colonels, forty-three majors, ninety-two captains and eight first lieutenants.

At the present time, we have one dental officer with the American forces in China, ten in the Philippines, twelve in the Hawaiian Islands, seven in the

Panama Canal Zone, one in Porto Rico, and 127 in Continental United States. Of those across the sea, all are assigned to full or part time professional service with the Army. Of those in continental United States, 114 are assigned to full or part time professional service, or are undergoing training. Of the thirteen not assigned to professional service, eight are instructors with the Reserves and two are engaged in dental research; one is on administrative duties, Medical Department supplies, and two are on administrative duties in the Surgeon General's Office. About 92 per cent of the Dental Corps are assigned to full or part-time professional duties.

At the Army Medical Center, Washington, D. C., we have a center of higher professional education for Medical Department officers. It is composed of the Army Medical School, the Army Dental School, the Army Veterinary School, the Army School of Nursing and Walter Reed General Hospital, of 1,500 beds, an average of about 1,200 of which are continually occupied.

The Army Dental School conducts a basic course for officers in postgraduate dentistry to further prepare them for their professional duties in the military service. All officers, on entrance into the Dental Corps, are immediately given this course.

The basic course for officers in the dental, medical and veterinary schools begins in September and extends for five months. On completion of this course, they are all given a four months basic course in field service at the Medical Field Service School at Carlisle Barracks, Pa. The Medical Field Service School is giving this fall its first refresher or advanced course and its first correspondence course for officers of the Medical Department, Regular Army, to which courses dental officers are eligible.

During the past fiscal year, twelve dental officers were given short special courses in postgraduate dentistry at civil institutions and at annual clinics of local dental societies, the tuition for which was paid from funds allocated to to the Medical Department for this purpose.

The Army School also conducts courses for the training of enlisted men in dental mechanics and dental hygiene. The course for mechanics begins on January 2 and extends for six months, and the course for hygienists begins at the same date and extends for four months.

In addition to 158 dental officers, we have authorized 198 enlisted men in the dental service. With this personnel, we are required to conduct a dental service for an authorized army today of 137,000 officers and men (Regulars and Philippine Scouts), and certain civilians connected therewith as are under regulations entitled to such service.

Most of our enlisted men are utilized as chair assistants, one to each operating dental surgeon. To our larger dental clinics, with three or more enlisted men, a noncommissioned officer is assigned. As our enlisted men develop in skill as specialists, they are promoted in technical rating in accordance with the provisions of regulations and as such ratings become available. Promotion in grade above that of corporal is by examination and subject to vacancies.

The limited dental personnel and the wide distribution of our Army into many garrisons, both large and small, necessitate itinerant dental service at many of the smaller ones. An attempt

is made to assign a dental officer to the staff of each hospital at stations having over 500 military personnel. To do this, only one dental officer is available for hospitals with larger garrisons, some of which have a military strength of 1,500 and more. At such stations, we assign more enlisted specialists. With a dental hygienist and a dental mechanic in addition to a chair assistant, one dental officer is enabled to increase materially the amount of service available in such garrisons.

The dental service in our Army functions as a specialty of the general medical service. With few exceptions, our personnel, engaged in professional service, are assigned to duty, in general or station hospitals or general dispensaries, where the patients receive the benefit of group medical service. The sick are surveyed in the several clinics, and the reports made by these services determine to a large extent the diagnoses and treatment. In many cases, the sick are referred back to the dental clinic for eradication of dental foci. All fracture cases, with involvement of the maxillae or mandible, are referred to the dental clinic for reduction, immobilization and treatment. Plastic surgery involving the mouth and face is performed by a medical officer, usually assisted by a dental officer. When prosthetic appliances are necessary in connection with this surgery, the appliance is designed, constructed and adjusted by the dental officer.

During the annual physical examination of officers and the annual dental survey of men, the personnel of our Army are classified into four groups. The Class I group are those requiring immediate treatment, emergency cases; Class II group, those requiring early treatment, such as may be advisable, for the prevention of more serious dental conditions; Class III group, those requiring extended treatment, such as the treatment of chronic conditions and the replacement of lost teeth, and Class IV group, those not requiring dental treatment. In addition to group medical service rendered by our personnel for the sick, we take up for treatment persons not in the hospital, and usually by classes, as they are numbered.

Some information in regard to the beneficial results which have been obtained by the more careful study of certain classes of diseases and the elimination of such foci of infection as are demonstrated around teeth, or elsewhere, has been gathered from a comparative study of the vital statistics of the white enlisted men in continental United States. The statistics for three periods are considered: (*a*) the pre-Spanish-American War period, from 1887 through 1897, or before the establishment of the Dental Corps; (*b*) the post-Spanish-American War period, from 1904 through 1915, or the formative period of the Dental Corps, and (*c*) that of the last five years, or after the establishment of the present Dental Corps.

The diseases selected for consideration are the so-called rheumatic and arthritic conditions: gout, acute rheumatic fever, acute and chronic arthritis (nonvenereal), muscular rheumatism, myalgia and lumbago.

Three groups of data are considered: (a) the number of men per thousand per annum sufficiently incapacitated to require relief from military duty and treatment in hospital or quarters; (*b*) the average daily number of men so incapacitated per thousand, and (*c*) the

average duration of treatment of each case.

The pre-Spanish-American War case rate was 36.56 per thousand per annum; the post-Spanish-American War case rate was 34.07, and that during the last five years, 13.57. Thus, this rate during this last period was only 37.1 per cent of that of the first one, and 39.9 per cent of that of the second.

The average number of men per thousand who were so incapacitated each day was, during the first period, 2.31; the second, 1.52, and the third, 0.71.

Possibly these data may be more intelligible if expressed in round numbers. During the first period, with an average daily strength of 22,323 men in the Army, there were, each year, 816 cases, and 18,826 days lost from duty. During the second, with an average strength of 49,659 men, or a force more than twice as great, the number of cases was 1,692, also more than twice as great; but the days lost were 27,473, or only one-third greater. Now, during the last period, with an average strength of 95,499 men, the average number of cases was 1,280, and the loss of time, 24,668 days. Thus, at this time, with a strength almost four and a half times as great as during the first period, there was only one-third more cases and one-third more days lost; and with a strength twice as great as during the second period, there was a reduction of 25 per cent in the number of cases, and a saving of 3,000 days.

In regard to the third factor; that is, of the average duration of treatment, there were 23.07 days in hospital for each case during the first period; 16.24, the second; and 19.28, the third. While there was then a material reduction in the loss of time from each case during the second period as compared with the first, more days were lost for each case during the last five years than during the second period. This may seem discouraging and might appear to indicate that our more modern methods of treatment are not so satisfactory, since more time is required before the patients are able to return to duty. But it is probable that, during the second period, patients were returned to duty at their stations, often with unsatisfactory results and probable recurrences, who, during the last five years, were sent to general hospitals for a complete physical survey and the elimination of such foci of infection as could be detected. Consequently, while the average time required for the treatment of a case was greater, the ultimate results obtained were far better.

Since so many factors enter into the health condition of the Army, and since these cases were under modern medical treatment during the last period and such dental treatment as was given was but a part of the modern medical service, it is impossible even to make an estimate from our statistics of the amount of credit which should be given the dental service for the great improvement in this group of diseases in the Army. Medical officers are convinced that much credit is due the dental service for improvement not only in this group but in all other diseases traceable to foci of infection.

While we have an excellent dental service in the Army today, considering our limited personnel, it is by no means so nearly complete as it should be. Regardless of every effort to extend proper service to all military personnel, the annual dental survey of enlisted men

this year, with 82,751 surveyed, indicates that 13,978, or 17 per cent, required immediate treatment; 20,556, or 25 per cent, required early treatment; 7,350, or 9 per cent, required extended treatment, and only 40,867, or 49 per cent, were reported as requiring no treatment at that time.

This is the first year that an annual dental survey of enlisted men has been obtained. The dental classification of officers has been compiled for the past three years. The indicated requirements for this more lasting group of personnel was for 1924, 1925 and 1926, respectively, as follows: in need of immediate treatment, 12, 8 and 7 per cent; in need of early treatment, 30, 24 and 22 per cent; in need of extended treatment, 14, 10 and 8 per cent; in need of no dental treatment at that time, 44, 58 and 63 per cent. These figures indicate that the officer group of our personnel is in better condition today than it was three years ago. On account of the great turnover of enlisted men in the Army each year, we know that such marked improvement has not been made in that group.

While improved efficiency in the dental service will be reflected in a better dental condition among all Army personnel, there is a limit beyond which it is impossible to go without more personnel. We are today approaching that limit, and about 50 per cent remain who are continually in need of dental service.

Dental diseases in our Army always have been and, as indicated by the foregoing figures, are today out of control. There is no known method whereby control can be gained with the present limitations in dental personnel. We need sufficient personnel to bring the recruit under treatment immediately on entrance into the Army and to bring all military personnel in need thereof under treatment at least once each year and to render proper prophylaxis and attend dental diseases in their incipiency.

The Regular Army is the highly trained nucleus of the greater Army of the United States and, in the interest of national defense, nothing within reason should be neglected which will prolong the active duty and efficiency of its personnel.

Owing to the rapid turnover of military personnel, resulting in thousands of new recruits entering the Army each year, many of whom have never had dental attention, an estimate of one dental officer for each 350 of military personnel, together with a proportionate increase in enlisted men for the dental service, would not be excessive.

About a year and a half ago, the Surgeon General called on the dental profession throughout the United States for help in building assured efficiency for an expanded dental service which would be necessary in a national emergency requiring mobilization. He requested each state dental society to appoint a special committee in its organization through which contact could be made with the dental profession of the several states. As a result of that appeal, we have today established this contact with the dental profession in forty-six states and the District of Columbia. Only two states, Nebraska and North Dakota, are today without such special committees.

This prompt response has gained the great admiration of the Surgeon General and the Army for the dental profession of America. The committees appointed have all been working com-

mittees and have assisted the Regular Army very materially in building assured efficiency for our service, should mobilization of the Army of the United States ever again become necessary.

The present War Department plans call for the enrollment of 5,188 dental officers in the Army of the United States. There has been a gradual increase in this enrollment and, at last report, we had 4,454 thus enrolled.

The plans call for not only enrollment but also assignment to military units in which the personnel are to serve and for training. Before intelligent assignments to units can be made, we must know the professional and certain other qualifications of the officers. Through the established contact with the dental profession, this information is gradually being obtained and proper assignments made. To each military unit is being assigned dental personnel who are especially qualified for the dental service which will be required in that unit. Since our special qualifications change from year to year, we contemplate that the qualifications of all dental officers will be obtained at least once in each five years and reassignments made as is necessary. This gives reasonable insurance to each dental officer that he will continue to practice in the Army the special line of dentistry which he practices in civil life. It insures the soldier who is drafted from all our homes indiscriminately in such emergencies that he will receive good dental service, and it promises the Government efficiency in the dental service.

The plans further provide for the procurement of equipment and supplies. Through the procurement planning section of the Surgeon General's Office, functioning under the direction also of the Assistant Secretary of War, who is charged with all procurement planning, we are completing equipment procurement plans for the dental service in all units.

On mobilization dental officers will come to active duty, not as individuals but automatically as their units are mobilized. Necessary equipment and about two month's supply will be shipped automatically to the units as mobilized. Replenishments will be obtained on requisition.

A certain number of unit assemblages have been procured and stored for immediate shipment to more essential units, such as hospitals.

In the United States Army Exhibit in this building, you will find the field dental sets which have been developed at the developmental laboratory at Carlisle Barracks, Pa., for our use in the field.

Eight officers of the Dental Corps, Regular Army, assigned to duty at eight dental schools throughout the United States, conduct Reserve Officers Training Corps courses. The students are given at least one hour's instruction in military science and tactics each week throughout the dental school course. In addition, they are required to attend one summer camp for six weeks' instruction in field service. On graduation, they are commissioned first lieutenants in the Dental Reserve Corps.

At graduation last spring, there were commissioned from these eight dental schools 217 dental reserve officers. In all the classes in these schools, in the past year, we had enrolled in the Reserve Officers Training Corps course

1,338 students. It is estimated that these units will provide a continual annual increment of about 200 officers to the Dental Reserve Corps of trained Reserves to replace normal losses.

For the training of Reserve officers after they have been commissioned, we conduct each summer fifteen-day courses in medical field service at Officers Reserve Corps camps throughout the United States. During the present summer, 422 Dental Reserve officers were ordered to this training. For those who cannot spare the time to go to camp and for those for whose training sufficient funds are not available, several Medical Department correspondence courses are conducted in each Corps Area.

OFFICERS IN DENTAL RESERVES AND REGULAR ARMY

	Colonels	Lieut. Cols.	Majors	Captains	First Lieuts	Total
Dental Reserves	7	53	347	1,043	2,846	4,296
Regular Army	4	11	43	92	8	158

During the past year, more than 2,200 Medical Department Reserve officers were enrolled in these courses, among whom were many Dental Reserves.

The dental profession of the United States entered its first war as a profession on April 6, 1917. We had but eighty-six Regular Army dental officers, thirty Regular Navy dental officers, a very few National Guard dental officers and no Reserves. The Regulars and National Guard had some practical experience as dental officers, and that was the extent of our training. We were without organization, not being listed on Tables of Organization for the Army.

The call to the colors was received by the profession on the declaration of war, and, Nov. 11, 1918, only one year, five months and eleven days later, more than 5,000 dental officers were commissioned and actually on duty in the Army. From the troops in training at home to the most advanced echelon of Infantry in Europe, we found the dental officer. Without transportation and without previous training, he accompained the troops. Such equipment for which he could obtain transportation was taken along, and he carried on a dental service as best he could. In battle, he assisted the medical officer in treating and evacuating the wounded.

Six dental officers were killed in action, forty-four died in the service and many today bear the scars of battle. In the Medical Book of Merit, we find the names of ten dental officers listed among those of the Medical Department who so distinguished themselves as to receive decorations from our Government. Six received the Distinguished Service Cross, two the Distinguished Service Medal, one the Navy Cross and one the Medal of Honor. The profession has every reason to be proud of its war record.

In closing I wish to pay my compliments to the dental officers of the United States Navy and in so doing to state that of the ten dental officers listed in the Medical Book of Merit, three were naval dental officers. When we consider the comparatively few officers in the Navy Dental Corps during the war, this is indeed a very exceptional record. In addition to the Navy Cross, they carried off one Distinguished Service Cross and the Medal of Honor.

THE DENTAL SERVICE OF THE NAVY OF THE UNITED STATES

By M. E. HARRISON, D.D.S., Washington, D. C.

THE Dental Corps of the United States Navy was established by an act of Congress which was approved by the President of the United States fourteen years ago last Sunday. It consisted originally of thirty assistant dental surgeons, who were appointed as members of the medical department to serve, professionally, the personnel of the naval service.

About six years later, the Dental Corps was reorganized. The president of the United States was authorized to appoint and commission dental officers in the Navy in the ratio of one for each thousand officers and enlisted men of the Navy and Marine Corps, and the new grades of passed assistant dental surgeon and dental surgeon were established.

In June of this year, a great step forward in the history of the Naval Corps was taken when dental officers were given the opportunity for promotion to the ranks of commander and captain. They were thus assured a reasonable flow of promotion and equality with all other officers.

From the foregoing, it will be seen that the Dental Corps of the Navy is still in its early youth, and that its brief history has been marked by rapid advances. It may not be amiss, at this time, to invite attention to the fact that much of the progress to which I refer has taken place during the terms of office of our present Surgeon General, Admiral Edward R. Stitt, whose interest and encouragement have been a source of inspiration to the officers of the Dental Corps.

The Dental Corps now consists of 159 officers, who are distributed in the ranks of lieutenant (junior grade), lieutenant and lieutenant commander. During the current fiscal year, this number will be augmented by nine additional officers, and approximately one half of the original appointees in the Dental Corps will be eligible for promotion to the rank of commander.

Dental officers are assigned to duty on board the majority of the larger ships in the fleet and on board many auxiliary vessels. A few craft of the latter type, such as destroyer tenders and hospital ships, carry two dental officers. All shore stations with complements of more than 500 officers and men have one or more dental officers, and dental service also is available for the personnel of insular stations and activities on foreign territory.

The policy of the Bureau of Medicine and Surgery is to concentrate dental officers at the larger Naval and Marine Bases, with a view to instituting preventive and restorative dental treatment for the greatest possible number of prospective officers and enlisted men as soon as is practicable after their entrance into the service. It is thus possible to send many members of the

*Read before the Section on Military Surgery at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

personnel to sea dentally fit, and to circumvent a considerable number of removals from the duty list on account of dental disease and its sequelae.

Dental officers who have been given special instruction in prosthodontia are stationed at the larger naval hospitals in order that prosthetic dental restorations may be undertaken for patients who urgently require treatment of that type for the maintenance of health.

Dental wards have been established in connection with the dental surgeries and prosthetic dental laboratories at the naval hospitals in Norfolk, Va., and San Diego, Calif. The facilities of these activities are modern and complete, and they may be regarded as material expressions of the spirit of cooperation in the treatment and care of the sick which exists between our medical and dental officers.

A plan has been adopted whereby the Naval Dental Corps may be expanded, in the event of a national emergency, to meet the needs created by large increases in the personnel of the Navy and Marine Corps. The size of the war time increment of dental officers would be governed by the nature and duration of the emergency, and the influx would be from the Naval Reserve, which is undergoing reorganization at present.

Supplies and equipment are issued to the service from two principal bases, in Brooklyn, N. Y., and Mare Island, Calif. In addition, supplies for the Asiatic Fleet are carried in a smaller depot at Canacao, in the Philippines.

The officers of the Naval Dental Corps have carried on their duties with credit and distinction in time of peace and in time of war. In this connection, I cannot refrain from calling to memory Dental Surgeon Weeden E. Osborne, the first naval officer killed on the land fighting overseas during the World War, and our other dental officers who passed on to the Great Beyond while serving with our forces afloat and ashore.

THE DENTAL SERVICE OF THE UNITED STATES PUBLIC HEALTH SERVICE*

By C. T. MESSNER, D.D.S., Washington, D. C.

ALL governments, in order to maintain their physical being and economic welfare, must of necessity maintain military establishments commensurate with the needs and requirements of the nation. The medical departments of these organizations are charged with and held responsible for the physical fitness of the military forces, which must be prepared and ready at a moment's notice to take the field to defend the nation from internal strife or from outside invasion. This is a huge undertaking and is made possible only by the fact that all men admitted to military forces, either as officers or enlisted personnel, must un-

*Read before the Section on Military Surgery at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

dergo a severe and rigid physical examination.

In addition to the military organization, this Government has established a nonmilitary but commissioned and uniformed service, the United States Public Health Service, which is made up entirely of medical and dental officers in its commissioned personnel, and has many and varied duties pertaining to medical work in connection with governmental affairs; all of which, summed up, could be interpreted to mean that it is the guardian of the health of the nation.

The history of the United States Public Health Service dates back more than a century. It had its origin in the old Marine Hospital Service, which was first authorized by Congress, by an Act approved, July 16, 1798. At that early date its duties were confined to furnishing medical care to sick and disabled seamen of the American Merchant Marine, either in hospitals maintained by the United States, or by contract with civilian institutions. It was placed at that time under the jurisdiction of the Treasury Department, where it has always remained. The evolution of public health functions from such a service was along natural lines. The medical officers, in providing care for the American Merchant seamen, who came to them from all ports of the world, were, oftentimes, the first physicians to diagnose such diseases as cholera, yellow fever, smallpox and the like, which were being imported into the United States. This was especially so in southern ports; and, during epidemics, when called on by the state and local health authorities, the President authorized the Marine Hospital Service to aid in giving relief and in the control of diseases.

From this early date, until the present time, Congress has added many and varied duties, and, since its early inception, has used it as the Federal Health Service. It was later given its present name—United States Public Health Service—and has as its organization, one surgeon general, in immediate control of all its activities; and seven assistant surgeon generals, in charge of its seven greater divisions, consisting of the Division of Marine Hospitals and Relief, Division of Scientific Research, Division of Domestic Quarantine, Division of Foreign and Insular Quarantine and Immigration, Division of Sanitary Reports and Statistics, Division of Venereal Diseases and the Division of Personnel and Accounts.

While the United States Public Health Service is nonmilitary, its officers have always been used by the military forces during the periods in which the nation has been at war. Its own wars and campaigns have been carried on relentlessly and continuously since its early history, against the armies of invasion of contagious and infectious diseases. In the great battles for control of epidemics such as smallpox, typhus fever, leprosy, yellow fever, cholera, bubonic plague and others, this service has taken a foremost place. It holds a prominent place in the medical history of the control of such diseases—such a history as that of the wonderful control of typhoid fever in the last fifteen years, where the death rate, which was formerly more than 50,000 lives annually of the population of the United States, is now less than 10,000. Many of its officers have been sacrificed in these wars, continually going on for control of these diseases and for the

protection of the people of our nation. The Hygienic Laboratory of the Public Health Service, located in Washington, one of the foremost research institutions in the world, with more than 50,000 square feet of floor space, and most excellently equipped, is dedicated to scientific investigation of the diseases to which man is subject, and some of the greatest discoveries developed in medical science in the last decade have been made possible through that institution.

Although it is perhaps the oldest Government medical organization in the United States, dentists were not commissioned into this Service until 1919, as evidently no need for them was ever found sufficiently great until that time. However, in these seven years, the dental officers on duty have demonstrated their usefulness in such a service and have been received whole heartedly by their brother medical officers.

At the present time, there are thirty dental officers on active duty, and thirty-five contract dentists, all of them in the Marine Hospital Division. This corps of dental officers is headed by a chief of the Dental Service, stationed in Washington, directly under the Assistant Surgeon General in Charge of the Marine Hospital Division. Their duties are purely professional. Stationed in the larger hospitals throughout the United States, all of them uniformly equipped with an accepted standard equipment, the work of these dental officers is such as would confront any dentists doing purely operative and surgical work. No restrictions are made regarding the dental treatment to be rendered to the beneficiaries of this service, provided such treatment is needed in order to hasten the patient's recovery or rehabilitate him for his former occupation.

The beneficiaries who are entitled to medical treatment and hospitalization are American seamen; officers and enlisted men of the Coast Guard; seamen of the U. S. Engineer Corps and Army Transport Services; U. S. Coast and Geodetic Survey; U. S. Lighthouse Service; Mississippi River Commission; U. S. Employees' Compensation Commission beneficiaries; certain immigrants, and the U. S. Army, Navy and Marine Corps.

In addition to the dental officers stationed in hospitals, one dental officer is sent to Unalaska, Alaska, each year with the United States Coast Guard Fleet which is sent there to guard the seal industry; and one dental officer is stationed at the United States Coast Guard Academy, New London, Conn.

Included in the hospitals of this service is U. S. Marine Hospital No. 66, at Carville, La., a 450-bed hospital devoted entirely to lepers, who are sent there whenever found in the United States. One dental officer is on duty at that station, and has been able to help very materially the unfortunate patients confined there.

A dental corps in a service so firmly established along certain lines could hardly expect to have accomplished a great undertaking in such a short period of time, but it should be pleasing to the dental profession to know that our Government, through the United States Public Health Service, realizes the necessity for dentists in the protection of the public health; and the United States Public Health Service stands firmly on the ground that medical and dental treatment are inseparable and come under one head. It believes that

it would be poor therapy to give all of its attention to one part of the human machine to the neglect of the other part, when, as is many times the case, the latter may be the contributing cause of a great deal of the trouble.

And so, as the dental corps becomes more firmly established, it sees opening before it great opportunities for investigative research of oral diseases, surrounded as it is by every necessary existing facility, and advised by a friendly medical organization with a history of experience and accomplishment reaching back for more than a century. "Rome was not built in a day," and the wonderful results obtained by the medical officers of this service were only possible through a long history of service successes and failures.

Compared with the medical profession, the specialty of dentistry is still a mere infant, but the splendid progress made by that profession has gained for it the recognition it so justly deserves.

The oral hygiene movement has developed the fact that the specialty of dentistry can be used in other ways than to construct appliances or correct pathologic conditions after they exist. Each year, the general public is realizing more and more that a vital relation to the general health is carried by the teeth and their surrounding tissues; and as it is accepted that so many diseases of man can be caused, or recovery retarded, by pathologic conditions coming under the jurisdiction of the dental profession, the dentist is admitted into that greatest of all fields—"preventive medicine."

The future and greater fields for dentists of this service will lie along these lines: investigation of diseases pertaining to dentistry; educational work regarding oral hygiene; cooperation with state boards of health in placing before the people of our nation the need for school dental inspection, and ways and means to correct abnormal conditions found.

After the Child Hygiene Section of the Public Health Service had shown by study and investigation that dental defects in children were far in excess of all other defects, a "preventive expeditionary force" was sent out by this service, consisting of one dentist, one oral hygienist, a mobile dental unit with field equipment and moving picture films showing mouth hygiene problems. In West Virginia alone, this unit visited forty-three localities and examined 7,059 children; and their work in that state resulted in the establishment of fourteen school dental clinics. Such work as that must be the part of any great public health movement, which must be an organized endeavor to obtain a further understanding of the causes of disease; an earnest effort to establish definite principles for the maintenance of health, and, through educational policies, dissipate ignorance and prejudice in teaching definite rules for hygienic living.

FOCAL INFECTION: THE DENTIST'S RESPONSIBILITY*

By BOYD S. GARDNER, D.D.S., Rochester, Minnesota

FOCAL infection should be of interest to every dentist, since practically every branch of dentistry deals with it, directly or indirectly. Even the prosthodontist should exercise care in seeing that the denture does not cover a hidden root or a residual area of infection. Crown and bridge work should not produce a condition around a tooth which might act as a focus of infection. This is also true of orthodontic appliances, attachments for removable bridges, etc. In brief, the dentist's responsibility in regard to focal infection is to find, prevent and eliminate conditions in and around teeth which may act as foci.

Extensive bacteriologic investigations at the Mayo Clinic and elsewhere have demonstrated that even pulpless teeth which show little or no evidence of infection from the roentgenologic standpoint are usually infected. The percentage is so high that all pulpless teeth must be considered potential foci of infection and should be extracted if the condition of the patient requires the elimination of all dental infection. With Price, I believe that the safety of pulpless teeth depends on the patient's defense rather than on the ability of the dentist to keep them safe. It has also been demonstrated beyond a doubt that such infected teeth may be the cause of disease elsewhere in the body, and since so much has been written on this subject, both from a clinical and from a laboratory standpoint, such papers have ceased to be of general interest to the dental profession. Accordingly, reference will be made in this paper in a general way to those phases of the problem which deal more especially with the responsibilities of dentists.

*From the Section on Dental Surgery, Mayo Clinic.

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DIAGNOSIS

That the roentgen ray has played an important rôle in the diagnosis of dental disorders, there can be no question. However, many teeth that may be factors in making a diagnosis may be overlooked unless sufficient exposures are made at angles which reveal the exact condition. Roentgenologic evidence alone does not suffice: testing for vitality is important to substantiate other data. Electrical testing is far from perfect, as a multirooted tooth sometimes gives a positive reaction when one of the roots is gangrenous. Moreover, it is impossible to test a crowned tooth electrically unless the crown is removed. Thermal testing also has its limitations. It may even be necessary to resort to the bur in order to make a diagnosis.

Impacted teeth and other teeth in malposition, as well as erupting teeth,

are also important factors, and here again the roentgen ray plays an important part in determining the necessity of removal, although infection around erupting third molars is easily diagnosed clinically. It is often difficult to determine the contact of these teeth with others, and such contacts often bring about a condition which acts as a focus of infection.

If the patient is absent and if a diagnosis is attempted from roentgenologic evidence alone, there is likely to be an error, and the diagnostician is handicapped unless he has had the advantage of at least observing the newer methods of extraction, since it is difficult, if not impossible, at times, to detect pathologic evidence from the films alone. The general appearance of the mouth, the articulation, the age of the patient and the use to which the teeth have been subjected are all important factors in a determination of the necessary procedure. At the Mayo Clinic, it has been found advantageous to make charts of the entire mouth, noting those teeth which should be extracted for local reasons, and, of the questionable teeth, which may be retained if the systemic condition of the patient permits.

In the Mayo Clinic, it has also been found a mistake to advise extraction of teeth until the operator is familiar with the patient's physical condition; but it is well understood that it is at times impractical, and many times impossible, for the dentist to obtain the cooperation of a physician. A brief history with special reference to cardiac pain, which can be taken by the dentist, will tend to lessen the risk of the removal of teeth. A history may reveal hereditary tendencies which have a direct bearing on diagnosis and treatment. As Price has pointed out, the dentist can be helped materially in this respect, as it will aid him in knowing when to be radical and when to be conservative in the elimination of dental infection.

The patient may come under observation with generalized pyorrhea, which the dentist usually treats from a local standpoint only. Perhaps newer responsibilities come to light when the question is asked: What is the cause? Is not this condition an expression of something which is going wrong generally? If such is the case, what can be accomplished by local treatment alone? Again, a patient may come under observation with marked caries affecting practically all teeth. Will merely removing the decay and filling the cavities stop the progress of this disease? Is not this an expression of faulty metabolism or of something which is going wrong elsewhere in the body? The necessity of cooperation with a competent physician in such cases is, no doubt, a newer responsibility, but nevertheless it is one which should be shouldered by the dental profession. It is difficult at times to find a physician who will do justice to such patients, and it may require a great amount of tact on the part of the dentist to persuade the patient to consult a competent physician. The reverse is probably just as difficult, as it is not uncommon to hear physicians report that they find difficulty in getting their patients into the hands of competent dentists. In summarizing this particular phase of diagnosis, an old saying is recalled, "A chain is as strong as it weakest link;" and unless every link of the chain of diagnosis and treatment is secure, the patient who is suffering from local infection will fail to be benefited permanently.

PREVENTION

Prevention must be considered prenatally as it is useless to try to correct a condition after birth which has been brought about by the mother's incorrect living, an insufficiency of sunlight in her daily régime and, especially, lack of a proper diet before her child is born. The work of Harris,[1] of England, has demonstrated beyond a doubt that, from the standpoint of dietetics, the responsibility regarding deciduous teeth starts as early as the forty-second day, and for the first permanent molars, as early as the eightieth or ninetieth day. Therefore, in our efforts to insure perfect teeth, it would be useless to expect to correct a dental condition by giving the child cod-liver oil, when the teeth in question were faulty before the child was born. Some dentists may feel that this responsibility is the physician's, and that the dentist's responsibility starts when the teeth can be seen. It is assuredly a branch of dental work which should be of interest to every dentist, and he should aid in giving this information through such channels that it will reach the public. It calls for closer cooperation with physicians and shows that dentistry is becoming a more important part of medicine.

The work of Owre,[2] Howe,[3] McCollum[4] and many others has proved the value of proper diet, and it is obvious that good teeth depend on the expectant mother's having a correct diet and sufficient sunlight before the child is born, and as long as the baby is breast-fed. When it becomes necessary to obtain food for the child elsewhere, the question is one of careful selection, with special reference to milk. We must make sure that the cows producing the milk are correctly fed and have sufficient sunlight.

Parents are likely to become somewhat careless regarding the child's diet after he becomes old enough to eat without assistance, even though they have been particular before. The habit of eating candy generally starts at this time, and even though a small amount of cane sugar will do no harm, one should consider that the child's capacity for eating is limited and the eating of candy may make it impossible for him to eat enough of other substances to counteract the evil effect.

Howe has suggested the following slogan: "A well-fed tooth never decays." Even though it is well-fed, it can still be helped by proper work, so it becomes necessary not only that the food contain the necessary vitamins to maintain good teeth, but also that it should be of a consistency to give the teeth the required exercise. Accordingly, the slogan: "A tooth well-fed and well-exercised cannot decay," would perhaps be a little more fitting. The use of a toothbrush cannot make up for the exercise that is lost by the eating of soft food. While it is true that, by its use, the gums are stimulated and the surfaces of the teeth kept clean, it cannot give the teeth the exercise which is acquired by the eating of hard food.

We cannot hope to educate the public along these lines to the point where the attention of a dentist will not be needed. However, it is the dentist's responsibility to take advantage of his opportunity to

1. Harris, H. A.: Personal communication.
2. Owre, A.: Personal communication.
3. Howe, P. R.: Personal communication.
4. McCollum, E. V.: Newer Knowledge of Nutrition, Ed. 3, New York: Macmillan Co., 1925.

prevent further trouble when correcting faulty conditions.

It is hardly necessary to mention that practically all teeth that act as foci of infection have been made pulpless by decay or because of it. Therefore, any method which will disclose decay is, according to Raper, worthy of careful consideration, and here the work of Raper[5] with a new type of roentgen-ray film is playing an important part. The Raper bite-wing film discloses cavities which cannot be found with an explorer, and, because of this, it is gaining in popularity.

Teeth are still being made pulpless by many dentists to withstand the necessary mutilation to make them bridge abutments, but as the technic of the newer type of abutments is being taught in dental colleges, this practice is rapidly diminishing. It is also well recognized that other teeth are made pulpless through injuries and by other improper dentistry.

TREATMENT

The removal of dental infection, either surgically or by other means, to correct a systemic condition, has often been a failure, not because of the dentist's work but because infection elsewhere in the body was not found and eliminated. It should be borne in mind that infection in and around teeth is only one link in the chain, and it is unfair to the patient to extract teeth which lack sufficient evidence of trouble to warrant their removal, unless the dentist has actual knowledge that other points of infection have been eliminated; in other words, a tooth which is not a local menace should be left as a last resort. Such action, therefore, hinges on direct cooperation between the dentist and the physician, and since physicians and dentists have developed better ways and means of making diagnoses, patients suffering with systemic disorders traceable to a focus of infection have been better cared for; for example, better results are being obtained in the treatment of infectious arthritis since the prostate has been included as a source of infection. To emphasize this point the following case is reported.

The patient was admitted to the clinic suffering from sciatica. Tonsils and prostate were found to be infected, and dental examination revealed that the two lower first molars were pulpless but roentgenologically negative. The patient's dentist strongly advised against removal of these two teeth because he believed these teeth could not be a source of infection unless the roentgenogram revealed so-called rarefied areas. The patient reluctantly gave his permission to have one of the teeth removed. The tooth was cultured and a streptococci infection found. At the time that this questionable tooth was extracted, the prostate was undergoing treatment, but marked improvement was not noticed until after extraction of the tooth. The patient was then more at ease than he had been for six years.

If the prostate had been overlooked and merely the two teeth and tonsils removed, this patient could not have been permanently cured. Again, it would have been unfair to have extracted teeth which were giving him service from the standpoint of mastication without elimination of the other two sources of infection.

Such examples emphasize that the extraction of teeth alone often fails to bring about systemic improvement and not only is disappointing to the patient but tends also to lessen the interest of the professions in focal infection. Moreover, it is regrettable that patients are sometimes assured of relief through the removal of foci of infection when it is far too late, a point emphasized by

5. Raper, H. R.: Personal communication.

Bumpus,[6] who says: "Septic teeth and tonsils are removed too often, with the assurance of benefit to the patient, after the heart has begun to beat irregularly, after albumin or pus has appeared in the urine, or after the joint has become deformed. Strange as it may seem, the idea that normal function can be restored to an irreparably injured kidney, a deformed joint or leaking heart valve, by removing a focus that initiated the disease years before, is apparently the most common misapprehension regarding focal infection."

Judging from the opposition of many dentists, the average practitioner does not appreciate that it is as important to extract pulpless teeth without rarefied areas at the apexes to relieve systemic conditions as it is to extract those with such areas. According to Price,[7] teeth with rarefied areas are more likely to be found in the case of patients with high resistance, and therefore the removal of pulpless teeth without evidence of infection should accomplish more in such cases than in cases of the other group. He has also pointed out that, after the areas have formed, the patient's resistance may be lowered but characteristic roentgenologic change around the infected areas is easily detected.

It should also be borne in mind that, even though a systemic condition traceable to a focus has not developed, dental infection in general tends to lower resistance and the extraction of infected teeth often brings about general systemic improvement for this reason only.

6. Bumpus, H. C., Jr.: Certain Aspects of Focal Infection Commonly Misunderstood, M. J. & Rec., 119: 333-338 (April 2) 1924.

7. Price, W. A.: Personal communication.

Newkirk,[8] of the California State Board of Medicine, in referring to resistance, states:

> Just as individuals vary in size, appearance, and so forth, it is reasonable to suppose that they vary in the matter of resistance to infection. One patient has a ruptured appendix and dies. Another has practically the same condition and makes a good recovery. So, through the whole list of diseases, one patient reacts favorably and another does not. Why is this? Allowing for difference in virulence of the bacteria and duration of the infection, we still have the major factor of resistance to infection or immunity which is of much importance in giving a prognosis, and especially in the matter of focal infection. If we had some way of measuring from time to time the resistance of an individual to a particular focus of infection, we could make a graph showing whether he was approaching the danger line or receding from it, and determine whether a tonsil, even though it contained cryptic material, should be removed in order to prevent the patient from crossing the danger line and developing arthritis. Whether this resistance should be measured in terms of blood chemistry by lymphocyte counts, or in some other way, we do not know but it seems of sufficient importance to warrant the most exhaustive studies and experiments.

The mere extraction of infected teeth is not the only responsibility the operator has at the time such teeth are removed, as many patients fail to derive benefit unless the associated pathologic conditions are taken care of at the time the teeth are extracted. The operator is also responsible for making a suitable foundation for the restorative work which is to follow, and the surgical preparation for restorative work is similar to that for a general surgeon in the amputation of a leg and the preparation of the stump for the artificial limb. The leg might have been amputated for a

8. Newkirk, H. D.: Resistance Factor in Focal Infection, California State J. Med., 21: 517-518 (Dec.) 1923.

gangrenous foot, but the added responsibility of the surgeon was to leave the stump in such condition that the patient would obtain maximal comfort from the use of an artificial leg.

It is far more important to study the tissues left than to study the extracted specimen. Here, postoperative roentgen-ray examination is necessary. Many patients have had teeth removed because of the possibility that they might be foci of infection, and it is discouraging indeed when the roentgen ray discloses remaining roots, and it is evident that the loss of the teeth was the only accomplishment. Patients are well aware that the roentgen ray, which shows a fractured bone properly set, is important, and for the same reasons, if given an opportunity, they welcome roentgen-ray examination of the jaws after extraction.

The extent of surgical procedure feasible at one time, the technic of extraction, the selection of the anesthetic and the preoperative and postoperative care all have a direct bearing on the subject of focal infection. If the dentist would apply to his surgical work the principles which have made other surgical procedures successful, better results would be obtained. The placing in hospitals of all patients who are too ill to have surgical work done in dental chairs would insure better results. Here, added responsibility is thrown on the faculties of the dental colleges, as it is well understood that young graduates lack the training which will make them feel at home in hospitals.

It should be borne in mind that practically every graduate in dentistry does some surgical work, even in his first year, and if the teachers would give to this part of dentistry the consideration that they give other branches, dentistry in general would be on a much higher plane, and the patients with dental foci would be benefited.

DISCUSSION

Weston A. Price, Cleveland, Ohio: This paper is important both because of its excellence and its timeliness. While I heartily concur in most of the conclusions presented by Dr. Gardner, I would place the emphasis a little differently were I reviewing the dentist's responsibility with regard to focal infection. The first question I would raise is, *What* dentist has great responsibility? Dr. Gardner, who is primarily a diagnostician and an exodontist, seems to review the matter chiefly from the standpoint of the diagnostician, who has the responsibility of making a program as an aid in the recovery of health. There is no question that the diagnostician's responsibility is all that Dr. Gardner has indicated. I would stress the responsibility of the dentist who is responsible for operations which invite focal infections. Dr. Gardner says, "If brief, the dentist's responsibility in regard to focal infection is to find, prevent and eliminate conditions in and around teeth which may act as foci." I would put more emphasis on the prevention that he seems to have done; in other words, I would use the term "dentists' responsibilities," and stress that we are dealing with a responsibility which relates to a great profession. As I see it, we have, in general, viewed this matter from a too restricted point of view. If the dental profession is to be indeed a healing profession, it must have its greatest concern for prevention of dental diseases and their sequelae. It is not sufficient that 50,000 or 60,000 dentists in this country shall spend their lifetime in the repair and replacement of diseased dental tissues. In the light of a more advanced professional outlook, that is an acknowledgment of failure in the fulfilment of our highest professional achievement. The best treatment for typhoid is its prevention. Similarly, the best treatment for dental disease is its prevention. But, somebody will say, "How can we prevent dental diseases when we do not understand their etiology?" Therein lies our responsibility: to find their cause. How much do we care, as a profession, that the causes of dental diseases shall be found? Every man answers that by the amount of individual sacrifice

and personal effort that he is making to that end. Yes, it averages about a dollar for each member a year; and the difference between that and what the knowledge is worth to humanity may be one way to express mathematically the dentists' responsibility. The time that is allotted to me for this discussion is far too brief even to tabulate a list of what I deem to be the dentists' responsibilities. Surely the chief one is to increase by many fold the effort in research on dental problems, to the end that the members of the dental profession shall know the fundamental laws of calcium metabolism in general and of tooth and bone formation in particular, in order that the diseases of the dental organs and their supporting structures shall not only be understood as to their etiology, but that means shall be at hand for their prevention. Until we can keep dental organs healthy, and to the extent to which we are unable to do so, we will have to repair and replace. These operations must be done in a manner that will conserve the health of other organs and tissues of the body. That the dentists' responsibility is not a local one but one which relates to the welfare of the entire body is well illustrated by the marked decline in the incidence of arthritis. Several internists have reported to me that they see fewer cases a year than they used to have under treatment at one time, and they ascribe the improvement to the elimination and prevention of dental infections. Clearly, the measure of the responsibility of the members of the dental profession is the measure of their opportunity to serve humanity in the matter of providing the maximum of health, comfort and efficiency, and they will do this chiefly by preventing the sequelae of dental infections by the prevention of dental disease.

H. W. Burnett, Fairmont, W. Va.: I should like to ask Dr. Gardner his position as regards the present status of our attitude concerning the matter of focal infection, as combated by the great majority of the practitioners and by some physicians. Would he stand alone for the removal of such teeth as have been designated? The great majority look for granuloma, and in the case of those that show no rarefied area, would, in the face of opposition, contend that they should be removed. In case the dentist should fail to remove the condition complained of by the patient in its entirety, he would assume the responsibility. Should he try to pass the responsibility on to the medical profession, to look farther? For many years I suffered from staphylococcic infection, so much so that I was incapacitated. Many dentists thought that because my teeth did not show rarefaction, they were harmless, but believing as I do, and did, I had those teeth removed. Do I look sickly? Many of my classmates in college said I had tuberculosis. I was suffering from focal infection from those teeth, and men of prominence in the profession, men who are here today, overlooked this condition in my own mouth. You have no knowledge except that which is your own experience. This experience has been mine, and since it has been mine, I am a disciple of this doctrine today, and I shall continue to be so until I have been proved wrong.

R. D. Temple, Burt, Iowa: I should like to ask Dr. Gardner if he considers the primary point of infection in and about a tooth or teeth, or does he look for another primary cause of infection in some other part of the body?

C. L. Straith, Detroit, Mich.: One rather important thing which has not been brought out here and which is causing a great deal of discussion among medical men and men doing more or less oral surgery is the question as to whether or not we should curet a socket. A few instances have occurred in this city in which severe systemic infection possibly has resulted after the removal of one or more abscessed teeth, and it has been brought to my attention on several occasions by physicians, who became quite alarmed at the extent to which teeth were being extracted and possibly the extent to which patients were being subjected to curettage after extraction. You all know that a general surgeon will open an abdomen and he will take out an infected fallopian tube, both tubes possibly, and the uterus, and think nothing of it. An orthopedic surgeon will open an entire femur or tibia, and possibly curet the entire femur or tibia, a greater area than that involved in taking out the teeth. Orthopedists, I believe, are more or less giving up the use of curettage. I should like to ask Dr. Gardner, then, what his opinion is regarding this. I feel that the rough curettage of any tooth socket with a sharp curet or even a dull one is liable to open up the bone spaces in the jaw, and

possibly subject the patient to a systemic infection. It has been my practice generally to try to dissect away a granuloma about the end of a root. If we cannot see it plainly, and few of them can be seen through a tooth socket, I believe that it would possibly be better to turn up a small flap, take out the buccal plate and curet without curetting the bone.

C. M. Woodward, Pasadena, Calif.: There is one point that I should like to have Dr. Gardner enlarge on. While I entirely subscribe to his position in these cases, I believe that we run a great risk in overemphasizing our attitude, to this extent: Many physicians who have become enthusiastic over the idea of eradicating focal infection in the mouth have come to the conclusion that if the person is sick, he must have his teeth out, without any diagnosis at all. Strange as it may seem, there are many people in my part of the country who insist on having perfectly good teeth taken out, despite a lack of clinical evidence that this is desirable.

M. C. Ellis, Williamsport, Pa.: I should like to ask Dr. Gardner his opinion regarding the extraction of teeth that have shown in the roentgen-ray film extensive granulomas and areas of rarefaction. Does he think it advisable to examine them again after a period of six months to see whether these areas are clearing up? Sometimes, after extraction, it is impossible to get the granuloma out. Will the condition clear up of its own accord, or is it necessary to check up after a time to see whether there is still a focus of infection present?

Dr. Gardner (closing): I have numbered these questions. Nos. 1 and 4 are practically the same. Will I take the responsibility in these cases? I take the responsibility when I have the cooperation of competent physicians. I am not going to have any physician tell me to take out certain teeth unless I believe that they should be taken out, and I won't take out certain teeth until I know that he has found and eliminated possible sources of infection in his field. The idea expressed in this paper is that it is difficult at times for dentists to get the cooperation of competent physicians. The reverse is just as true. If we have a patient suffering from a systemic condition, traceable to a focus, and we have done our part and have assumed that the physician has done his part, the question to ask is, Am I going to avoid or am I going to assume the responsibility in such a case? No one can make promises. In almost ten years in Rochester, I have never, I believe, made a promise to a patient. Cases are referred to our section primarily as an aid in making the general examination. That is our link in the chain. But we do not do anything in the way of treatment until the entire examination is completed, and the cards are on the table: "This is for you to do; this is for me to do." Many times, three or four things are being done at practically the same time. We can't do research work on these patients and wait; say, "you do your part, and we'll wait a year or two to see if the patient is going to get well." The patient is there to get the best that there is in this clinic, and, as I say, we may be working at the same time, and one cannot get the credit of bringing about the result unless there is only one thing done at one time. Question 2: It is quite true that we have secondary as well as primary sources of infection. The house may be on fire; a spark ignites the barn. We may pour all the water in town on the house and put out the flames, but the barn is still on fire. The point that I brought out, and that Dr. Price emphasized, is, don't wait until the joint is deformed or you have an irreparable kidney or a leaky heart. If there is anything in focal infection, one tooth should infect the other if conditions arise. A point that I brought out almost nine years ago is this: If you are still doing root canal work, be pretty sure that you have cleared up all bad teeth and extracted those that should be extracted, giving attention to root areas, etc., before you open into the pulp, because, no matter how careful you may be it may be a case in which the dentin is not yet infected; in fact, you may be removing a pulp that is vital and healthy, the root end may become infected within a few hours after you are through. Before I discuss curettement, we should all have to agree on what we mean by the term. One man says he curets when he takes a delicate instrument and scrapes out the granular tissue from the tooth socket; another curets when we can hear him scrape: the same thing, in the eyes of many perhaps. I am going to take into consideration the thing that I have to do. If this tooth that I have extracted shows definite evidence of infection

around the apex and has been in disuse, I know that all the process around is very soft, and I can't be guided by feeling. If the cuspids and molars on the upper right side have been in disuse for years, I can take them out and curet with ease from the third molar region to the cuspid, without meeting any apparent resistance, because the process is so soft. I could go into the antrum without knowing it if I were guided by feeling. So we take advantage of what we see in the roentgen-ray film, and employ a technic by which we can visualize what we are doing, and we can, with ease, determine how far we should go in the so-called curettage. If I have a tooth that is in use, and that has a definite granuloma, I am not going beyond that granuloma. If I extract the pulpless tooth that has no rarefied area, I go over the socket very carefully, not with the idea that I am removing the area of infection that is around the tooth, but I wish to promote development of better clots, to take care of repairs. If we are taking out all the teeth; if dealing with pathologic conditions of different kinds; if we wish to determine how successful we have been; if we would know whether we have eliminated infection, a checkup by roentgen ray every six months or every year or two is necessary. If the roentgenogram is not taken immediately afterwards, we can't learn much in the way of a checkup; hence, the importance of immediate routine postoperative roentgen-ray examination. If we have a patient with a certain systemic condition and we take out the teeth today and check up at six months, or a year from now, and regeneration of bone has not taken place in certain sockets or areas, what is the cause? Was it the technic? Isn't it possible that the systemic condition of the patient was playing the important rôle in that failure, for the same reason that a certain patient gets a fracture and it doesn't unite? and here the idea of diet comes. We are going to learn this, that when the process disappears beneath dentures, it is for the same reason that the process was lost before the teeth were extracted. It isn't your fault when, after you put a plate in my mouth, the process disappears underneath it. The plate wasn't the cause. In the next patient, this did not occur. The difference lies in the systemic condition. Something is lacking in the dietary intake or something in our ability to assimilate what we take which causes the loss of bone in the mouth, either before or after extraction.

THE MEASURE OF SUCCESS IN PERIODONTIC PRACTICE*

By JOHN OPPIE McCALL, A.B., D.D.S., F.A.A.P., F.A.C.D., New York City

THE title of this paper is intended to convey the thought that the time has arrived when it is needful that we set up standards by which we may judge whether or not attempted periodontic treatment has terminated successfully. It is also intended to call attention to the fact that success in periodontic practice is attainable.

The latter point may well receive consideration first. As we review the literature and also the consensus of opinion of dental practitioners, we are met with a strikingly uniform pessimism as to the possibility of successfully treating cases of established periodontal disease. Riggs was the first to claim success in this field. His claims were based on the standard of cessation of suppuration, relief of gingival inflammation and increased firmness of the affected teeth. I shall not question these standards or the method of arriving at them at present, but shall pass on to Younger, who was the next dentist to take an optimistic view regarding the possibility of successfully treating periodontic diseases. His claims as to the details of what constituted success in treatment were similar to those of Riggs, but with the important additional claim that he obtained reattachment of the detached gingival tissue.

Since the day of Younger, an increasing number of dentists have come forth with the assertion that they could successfully treat periodontal disease. At the present day, so great is the number of those who claim success, and so acceptable have been their claims to those who have seen the results of their treatment, that it may be stated without fear of contradiction that this type of oral disease is actually curable. This statement will undoubtedly be received by those who hear it, without question and, in fact, without surprise, and yet, but a few short years ago, one heard on all sides that so-called pyorrhea alveolaris was a hopeless disease and that treatment for it was at best palliative.

When we come to study the standards on which claims of success have been made, we find a lack of uniformity and a lack of exactness regarding points which must be considered in setting up of such standards. Observation of cases treated which have responded to the satisfaction of the operator, and consideration also of the statements regarding cases treated, indicate that there is a wide variation of the standards which various operators set up for themselves in this regard. Without wishing to be hypercritical, we may properly call attention to the fact, that some operators seem to be satisfied with a state of affairs which is, in effect, simply an amelioration of the symptoms which were present when treatment was begun. To these oper-

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ators, a diminution in redness of the gingival tissue, a lessening of pus flow and a lessening of the tendency to hemorrhage have yielded satisfaction. That the teeth so treated were eventually lost through a continuation of the original disease has not diminished their ardor. It is not to be denied that even such results have been of value; for they have at least indicated the possibilities of a more complete success, and have furnished a definite step in the development of a more successful treatment.

As efforts in this field have yielded results more nearly ideal, it has been necessary for us to advance our standards of success. For a number of years, we have regarded as satisfactory that case which showed a more or less complete return to normal firmness of the tooth, the establishment of dense, pink gingival tissue and absence of any pus which could be detected by the naked eye. It has not, in the past, been considered essential to a satisfactory result that pockets should be obliterated. It has been claimed for some years now, however, by a number of operators, that obliteration by reattachment was possible, they, thereby, setting this up as an advanced standard. Others, accepting statements that such reattachment was impossible, have demanded pocket obliteration by surgical removal of the overlying tissue. In either case, the thought has been clearly indicated that the elimination of the pocket was necessary for complete success.

Let us now examine the various items which have been mentioned with a view to establishing more exact standards of health for the various tissues involved. And at the same time let us keep in mind the possible consequences of failure to achieve entirely satisfactory results. The latter point requires consideration for the reason that, to fall short in treatment may mean the loss of savable teeth; and, in addition, the retention of teeth having even slight periodontal inflammation may mean the prolongation of a state of disease which may be demonstrably prejudicial to the health of the patient. No longer can we be satisfied with the results with which we have been so pleased in the earlier years of our efforts in this field. The capable operator will need no such admonition. But the general practitioner who feels the necessity of providing for his patients a treatment which the public is now beginning to demand must, if he is conscientious, regard critically the results of his labor. No longer should he be satisfied with more or less increased firmness of the teeth treated, slight improvement in the coloration of the gingival tissue and mere diminution, not cessation, of pus flow.

Before proceeding to a consideration of the requirements in the treatment of advanced cases involving pus-pocket formation, it will be necessary to discuss cases in which disease has progressed to a lesser degree. First of these is that type commonly spoken of as recession of the gingivae. When this disease, also known as ulatrophia, is observed in uncomplicated cases, it presents no discernable symptoms of inflammation. It has been found by Box that it does actually show evidence, under the microscope, of an inflammatory reaction. This fact is of considerable significance, from the standpoint both of pathology and of treatment. We must first recognize the fact that inflammations are progressive. In other words, an inflammatory disease, unless checked, progresses with an increase in the inten-

sity of the destructive process. This disease therefore assumes its rightful place as a step in the progression leading to an infective periodontitis. This is a fact not generally recognized at the present day.

Since inflammatory symptoms in this disease are so meager, it becomes difficult to set up a standard for success in its treatment. Complete diagnosis with reference to all possible etiologic factors comes first. Thorough elimination of all these factors, together with continued observation for extension of the disease process, is essential. In addition to this, microscopic examination of the fluid found in the gingival crevice, for the presence or absence of plasma cells, etc., is necessary for a definite determination of success.

In gingivitis, inflammatory symptoms are readily perceptible. They consist chiefly of redness and swelling of the marginal and cemental gingivae. There is also, in most cases, a tendency to hemorrhage on touching or brushing the gingivae. In this type of disease, complete return to normal coloration and contour, with cessation of bleeding, is essential to success. Microscopic examination of the gingival exudate is valuable but may not be essential in determining the requisite improvement. It is necessary, however, that no trace of abnormal redness remain in the diseased tissues; nor should there be hemorrhage with the use of the toothbrush or contact with coarse food. Tenderness should also be absent. It is a fact that too many dentists are satisfied with a partial improvement in these cases. When bleeding has diminished to such an extent that the patient no longer complains of it, and the redness is less noticeable, the dentist is likely to feel that he has reached his goal. Needless to say, even a diminished inflammation will progress as a disease process. Such progression is particularly to be expected when the gingivitis is accompanied by those deeper changes which so frequently occur, and of which the gingivitis itself may be a symptom. Failure to achieve entire success in the treatment of gingivitis may sometimes be due to a failure to eradicate the causes of these deeper changes. It might be well to call attention at this time to the fact that traumatic occlusion, through its effects on the circulation in the pericementum, is frequently a causative factor in gingivitis. When this is so, this pathogenic agency must be eliminated before entire success can be expected in the treatment of the gingivitis. This statement is quite as applicable to cases of phagedenic gingivitis, or Vincent's infection, as to the more commonly occurring types.

At an earlier stage in the development of our knowledge of periodontal disease, it was considered reasonable to designate by the name alveoloclasia, a type of disease which seemed to be an intermediary between gingivitis and ulatrophia on the one hand, and pericementoclasia or pus-pocket formation on the other. It has now been determined by Box that this is a symptom of advancing rarefying pericementitis fibrosa. It thus looses its identity as a type of disease and will accordingly be discussed here along with pus-pocket formation, or, as Box has it, periodontitis complex.

In this type, or to be more accurate, in this phase of periodontal disease, we find the following symptoms: redness and swelling of the marginal gingiva, looseness of the tooth and separation of the periodontal tissues from the root, with consequent formation of a pocket

from which pus may be obtained. This phase of the disease is the one usually referred to as "typical pyorrhea." The first fact which we need to emphasize is that it is not a disease separate and distinct from ulatrophia and gingivitis, but merely an advanced stage of these diseases. With reference to success in treating this disorder, it will be obvious that those requirements which have been stated as standards to be attained in the treatment of ulatrophia and gingivitis will be a part of the requirements to be set up in the treatment of periodontitis complex. In addition to the need for eliminating redness and abnormal contour of the gingival tissue, as well as tenderness of the gingiva and absence of hemorrhage, we must have firmness of the tooth in its socket, and closure of the pus pocket. It is only by this closure that we may assure continued freedom from pus formation. Persistance of the pocket, or some portion of it, may be condoned, provided it is found by microscopic examination that pus formation has ceased.

The latter point is mentioned because of the fact that circumstances, which I shall not detail here, may interfere with the attainment of that degree of success represented by closure of the pocket. Under such circumstances, the utmost care must be exercised to assure the actual and continued health of the tissues involved in order that the affected tooth or teeth may safely be retained in the mouth.

If teeth are to be retained with persistent pockets, it requires something more than naked-eye observation to assure the operator of the actual absence of pus. Once more, let me repeat that too many dentists, in their desire to keep teeth in their patients' mouths, because of the patients' very natural demand for this service, will express satisfaction over the condition of teeth which have actually shown but little diminution of the symptoms of disease. Gums remain thick at their crests; teeth are far from being firm, and the color of the gingivae indicates only too plainly that disease is still progressing. The application of a definite standard of success will at once settle the status of such teeth.

Even when the symptoms which have just been mentioned are eliminated and success may fairly be claimed, the maintenance of health in the presence of persistent pockets becomes a problem which may be solved but which constantly demands solution afresh. As long as the pocket persists, there is a constant tendency to reinfection and renewed pus formation. How much happier that state of affairs in which the pocket has been eliminated by closure and in which after-care resolves itself chiefly into a question of preventing recurrence of inflammation of the marginal gingivae.

While it is not the object of this paper to deal with details of treatment, it seems proper, because of its very recent publication, to mention a method which I have found most satisfactory for inducing elimination of pus pockets by reattachment of overlying gingival tissue.[1] This method, with which I have experimented for several years, has, within the past year, been developed to a point where a high degree of success attends its use. Briefly, it is founded on the assumption that the epithelium which is usually found to have extended down the inner wall of

1. McCall, J. O.: An Improved Method for Inducing Reattachment of the Gingival Tissues in Periodontoclasia, Dent. Items Int., May, 1926.

the gingival tissue which forms the pocket constitutes more or less of a barrier to reattachment. Reattachment of epithelium may occur, but this seems less likely to happen than reattachment of connective tissue to the tooth root.

Removal of this epithelium seems to be the logical method to follow in the effort to induce reattachment. In the same way, it is found necessary, in dealing with the closure of wounds in soft tissue, to remove epithelium from the surfaces concerned in the union. Epithelium does not readily attach itself to epithelium, nor does it apparently readily attach itself to cementum. The removal of epithelium from the wall of the pocket is a delicate procedure and hardly to be accomplished surgically in safety. The cautery has proved unsatisfactoy. It has been found necessary, therefore, to resort to drugs for the accomplishment of this result.

The drug which was selected for this purpose was sodium sulphid, which is known to pharmacists as a depilatory. It accomplishes the removal of hair through virtue of what seems to be a solvent effect on epithelial structures, of which hair is one. The formula is as follows:

Sodium sulphid	150 gr.
Sodium carbonate	40 gr.
Aqua q.s. ad	2 oz.

The method of application and length of time vary according to the nature of the case. When the pocket is narrow and deep, and when the overlying tissue is tense, the application may be made most suitably by means of coarse size paper root-canal points saturated with the solution. The pointed end is cut off and rejected, the remaining portion being left slightly longer than the depth of the pocket. The point is caught on the tip of a sharply pointed explorer, so shaped as readily to enter the pocket. The paper point, having been saturated with the solution, is then carried to the base of the pocket. Other points are carried into the pocket in a similar manner, until it is completely filled. In a case which has not received previous periodontic treatment, the points are left in the pocket for ten minutes. The mouth may be rinsed with any agreeable aromatic, in order to carry off excess solution and to modify the odor of the hydrogen sulphid which is liberated when this drug comes in contact with the acid contents of the pocket.

After the points are removed, a fine curet is passed into the pocket, and with this the soft tissue wall of the pocket is gently curetted. If the drug has accomplished its purpose, varying amounts of disorganized epithelium will be withdrawn from the pocket, and a fairly profuse hemorrhage will ensue. The tooth is then left without further interference, and is not disturbed by instrumentation for at least seven days. In from seven to ten days, more or less complete closure of the pocket will have taken place, if the preliminary treatment has been properly carried on.

This preliminary treatment consists, in most cases, in the correction of traumatic occlusion, the stimulation of the gingival circulation by means of the toothbrush, the complete removal of apoxemena and the restoration of contact points, etc. Too much emphasis cannot be laid on the correct performance of this part of the treatment, if closure of the pocket is to be expected. Failure in any one of these essentials, in even slight degree, will nullify the effect of the sodium sulphid.

In a case which has received previous treatment but in which closure has not occurred, it frequently happens that the pocket requires a longer application of the drug. This may be most effectively made by removing the cotton points at the end of five minutes and making a fresh application immediately, this second application being left in for from seven to ten minutes. When the pocket is broad or tending toward the so-called horizontal type, the application may be made most conveniently on a thin rope of absorbent cotton. This is carried to the bottom of the pocket and folded on itself in tampon form until the pocket is well filled.

Since devising this technic, I have not failed to secure some measure of reattachment in every tooth treated. The extent of reattachment seems dependent on such factors as the degree of relief of excessive occlusal strain, the perfection with which contact points may be restored and, of course, the perfection of apoxesis or instrumentation.

This method thus not only serves as a means of securing that most desirable result in treatment, the closure of the pus pocket, but furnishes a standard of success in treatment, since it seems to act universally when properly used, and is ineffective when the preliminary treatment has been inadequate.

Whether the pocket is entirely eliminated, or whether the case presents no pockets but simply an earlier phase of disease, success in treatment can be claimed only when the highest standards of health are applied as a gage.

100 West Fifty-ninth Street.

DISCUSSION

Paul R. Stillman, New York City: The method which Dr. McCall has described is sound and will do what he claims for it. I wish to describe a modification of his technic which, to my mind, has proved more satisfactory than that which he has advocated. Briefly, I twist a slender yarn of absorbent cotton of sufficient length, saturate one end with the sodium sulphid solution and carry one end of this to the bottom of the pocket with a spatula-like probe, having first explored the pocket to determine its depth and area. The cotton is then progressively packed into the pocket in tampon form until the pocket is full. This is left in for about ten minutes and the cotton is then removed. The distention thus produced causes easy access to the entire area of the pocket and scaling is then begun. After the root surface has been completely freed of detritis, another application of sodium sulphid is made in the same manner as at first. This is left in for fifteen minutes. It is then removed and the pocket is not further disturbed. You will recall that, in the treatment of cases involving deep pocket formation, considerable shrinkage of the gingival tissue occurs during the period of healing. When the technic that I have described is followed not only is healing much more rapid, but shrinkage also takes place much more rapidly and the gum tissue very quickly assumes the form which it would ordinarily attain when healing was complete. While I have presented to you a different technic from that advocated by Dr. McCall, I wish it understood that I heartily agree with the method which he has outlined.

Dr. McCall (closing): It is my hope that all who read this paper will try the method described, and that all will have the pleasure and satisfaction in its use that I have had. Regarding the technic advocated by Dr. Stillman: I quite agree that rapid and satisfactory results may be attained by its use. However, when so strong an application of the solution is made, a definite and sometimes unnecessary wasting away of the margin of the gingiva is induced. It is with the thought in mind of conserving all gingival tissue which can be saved that I have advocated a technic which may be less rapid in its action but which will surely not cause unnecessary loss of gingival tissue. When we consider the importance of the gingival tissue in aiding the maintenance of hygienic conditions in the mouth, we must agree that the conservation of this tissue is, from that standpoint, very desirable.

INTRA-OSSEOUS ANESTHESIA BY INJECTION*

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ANY lengthy exposition of the subject of intra-osseous (or intra-alveolar) injection anesthesia at this date would be out of place. At the ill-fated Sixth International Dental Congress, held in London in 1914, and so tragically cut short by the outbreak of the Great War, I presented a paper entitled "Injection (Intra-Alveolar) Anesthesia in Conservative Work," which will be found in the recorded transactions of that congress (pp. 561-567). Therein were fully summarized the advantages and disadvantages of this method as one of our most effective weapons in combating the possible pain of conservative dentistry, and I would rather refer the members interested in local anesthesia to those transactions than to run the risk of wearying them with needless repetition. The paper referred to embodied my experience with this particular method and its crystallization into a routine technic over a period of about ten years. In 1909 and 1910, the method was demonstrated clinically at the annual meetings of the British Dental Association and at many branch meetings subsequently; and, today, the technic of operation remains, at least in my hands, identical with that practiced a decade since. But the value and scope of intra-osseous injection have, in the meanwhile, altered considerably, owing to the advances made in the technic of regional anesthesia or nerve-blocking methods, and, at the present date, it is worth while to consider its position and value in practice in relation to more modern methods.

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PRESENT-DAY VALUE OF THE METHOD

At the time when the method to be described was first introduced, infiltration anesthesia by submucous or subperiosteal injection was practically the only method that was of much value in abolishing the pain of conservancy operations, such as cavity preparation and extirpation of pulps. Others had been tried, cataphoresis, freezing spray, pressure anesthesia, the use of obtundents, etc., and some of these still have a high occasional value among the varying conditions and patients with which one meets in practice. But infiltration anesthesia had many drawbacks at that time. Knowledge as to the potential effects of the drugs used, cocain, procain and epinephrin, was not so exact as at the present day, and, therefore, the amount of any injection administered was of prime importance to avoid toxic reactions. Secondly, infiltration anesthesia was very uncertain in the majority of cases in which anesthetiza-

tion of apical nerves was desired, and, at the best, was often so long delayed in its action that no time was left for the operation proper, i. e., the painless preparation of one or more difficult cavities. Intra-osseous anesthesia gave in a vast number of cases these four marked advantages: (1) diminution of the dose injected; (2) increased certainty of action; (3) increased rapidity of action, and (4) prolongation of the anesthetic period.

There is little doubt that, in the earlier days of injection anesthesia, many untoward symptoms and sequelae resulting from injections were wrongly attributed to the anesthetic drug, cocain, procain, etc., instead of to the suprarenal compound with which this was usually combined.

The vasoconstrictive action of epinephrin was gradually more carefully proportioned to the anesthetic drug. Other factors, such as time of administration and circulatory weaknesses, were more carefully noted, with the result that the scope of infiltration anesthesia was widened in application, and the use of a distinctly intra-osseous method diminished. In addition came the growing practice of regional anesthesia and the better recognition of the nerve supply and anatomy of the teeth and their surroundings.

Apical nerve blocking is now the term used to signify an injection made over the apices of the teeth, though actually it is merely a variation of infiltration anesthesia. The dentist, like other mortals, is largely a creature of habit, and if, as is usually the case, he has a stock of fine needles, he will use a fine needle in his syringe all the time. In the same way, he uses a favorite excavator or plastic instrument, where another would do the work more quickly and effectively with a gas apparatus or a gazotherme (if he has one), simply because he is used to it and the particular method has suited him before. In former days, I regarded interosseous injection almost as a routine method and practiced it accordingly. In the light of later developments, the freer scope of infiltration injection and the occasional use of a nerve-blocking method, the use of the intra-osseous method takes its place as more of an occasional than a routine procedure. None-the-less, it is a valuable adjunct, and in cases in which infiltration of the bone by submucous or subperiosteal injection is likely to be slow or ineffective, and nerve blocking is uncalled for, the rapidity and certainty of anesthesia being produced by the actual introduction of the anesthetic fluid into the cancellous bone make it well worth while to practice and master a method which is simple in principle but requires a little technical skill and observation to be of great value to both operator and patient, and avoid disappointment for both. Unfortunately, the usual procedure probably is that, first, a full injection is made submucously. When apical anesthesia fails to materialize, either a further injection, submucous, is made, and with much delay anesthesia is achieved, or the patient must put up with what has to be done. In any case, he or she will be none the better for a double injection.

The technic of the method here described is identical with that set out in the *Transactions of the Sixth International Dental Congress.* (pp. 561-567), and for reasons which follow, I still consider it most satisfactory in practice.

TECHNIC OF INTRA-OSSEOUS INJECTION

1. A high-pressure syringe, holding 30 minims or 2 c. c., is filled with a 2 per cent solution of procain-epinephrin, an ordinary sharp fine needle being mounted. With this, a preliminary injection of from 3 to 5 minims is made into the submucous tissue at the most convenient spot, usually the interdental papilla adjoining the tooth or teeth to be anesthetized, on the labial or buccal aspect.

2. While this is taking effect, the ordinary sharp needle is changed for a heavier one, clearly bevelled to the point, but not sharpened. A clean round-headed bur of a size corresponding to the point of the heavy needle is placed in the engine handpiece and the head dipped in pure phenol (carbolic acid).

3. With this bur, a small perforation is made through the soft tissues and surface layer of compact bone into the cancellous bone beyond. The yielding touch of the latter is readily distinguished and the bur at once withdrawn.

This little operation is simple enough in principle but may present technical difficulties in practice, owing to anatomic variations, etc., and on its successful performance the whole operation depends. The following points should therefore be borne in mind:

a. Needless laceration of the soft tissues is avoided by tightening them with a finger of the left hand, and pressing the stationary bur firmly and squarely against the site of perforation before the engine is started.

b. The nearer the perforation is to the level of the apices of the roots, the more quickly will anesthesia be obtained, but the mobile soft tissues should be avoided if possible; otherwise the patient may be conscious of a little soreness in the slight wound later, through its movement by muscles.

c. The objective of the bur should be the thickest part of the alveolar septum, to avoid contact with peridental membranes. A little observation will quickly inform the operator of the presence of crowded roots, and he will choose his spot accordingly. The roentgen ray, naturally, is an assistance in this respect, though not indispensable.

d. A round or short pointed bur is, I think, preferable. A straight drill or fissure bur causes more laceration through "wrapping up" in the soft tissues, and a short headed bur makes the yielding of the cancellous bone, when it is reached, more readily distinguishable to the touch.

e. Cancellous bone must be reached to obtain a perfect success. Otherwise, resistance to the passage of fluid remains, and subsequent soreness may result from needless distension of tissues.

f. The escharotic action of the pure phenol is not merely for sterilization of the bur: it assists materially in locating the perforation again by the whitening of the margin of the puncture, and also, by cauterizing the margin slightly, it may assist subsequently as a drainage outlet.

4. The perforation being successfully made, the heavier needle is carefully inserted in the orifice in the bone, with slight pressure, and the desired dose of remaining solution is slowly and steadily injected, the injection being carefully watched. If leakage occurs, it may be observed by the increased blanching of the gingival tissues, but with the conical needle fitting snugly into the perforated compact bone, this will not happen. The dose thus administered

will vary according to the distance to be traversed by diffusion in the bone and the duration and extent of anesthesia desired. Usually, from 4 to 5 minims suffices. If it is necessary to extend or prolong the anesthesia, it is easy to reintroduce the needle and give a further dose, taking care to avoid the introduction of mucus, saliva, etc., with the solution.

On the completion of the injection, burring or excavating may usually be proceeded with at once, and painlessly. If not, the anesthesia will deepen in two or three minutes. If rapidly obtained, it will prove more enduring, and ample time will be available for the preparation of cavities or removal of pulp as the case may demand.

DRUGS AND INSTRUMENTARIUM EMPLOYED

To the foregoing description of the particular method advocated here, it seems necessary to add a few reasons for the slightly specialized technic employed. As regards the drugs used: procain is chosen, chiefly on account of its being the least irritant to the tissues, a point of importance in all injections, but of greater importance still in deep injections with bony surroundings, when a slight inflammation would make its presence felt more seriously than in soft tissues. Formerly, I made a practice of using only freshly prepared and boiled solutions, but solutions in ampules can, I think, be even more relied on for sterility if reliable otherwise. The question of sterilization of the operating field, instruments and drugs is one I can pass by here. The methods are many, and a sound operator may nowadays be relied on to do his best to ensure that his technic shall be as far as possible aseptic.

The high pressure syringe which is mentioned in the technic is one known as the "Sykes." It is a combination of the syringe, originally I believe known as the "Imperial," with a ratchet principle, which gives power and also guards and restricts the injection. This syringe may appear complex at first glance, but, in reality, it is easy to use and simple to take to pieces and reassemble. Objection may be taken to it in that it contains washers, but as it is of the compound pressure type, with the piston merely displacing the fluid but not fitting the barrel, some sort of washer is necessary for tightening round the piston. The usual leather may be replaced by asbestos, but, in either case, it is not difficult to keep the whole syringe sterile by boiling and immersion.

REASONS FOR SPECIALIZED TECHNIC

The heavy needle I have come to regard as necessary to assure a neat and successful injection. Obviously, it is a little simpler to insert the same fine needle used in the preliminary injection into the perforation made in the bone, and by pressing the bur of the needle mount against the tissues, attempt thus to complete the injection into the bone. I am strongly against this practice, for several reasons:

a. If too fine a bur is used, it is very easily broken and remains embedded securely in the bone; therefore, the bur hole must be larger than the fine needle.

b. A fine needle also is too easily broken by slight lateral movement if the needle mount is being pressed against the bone to prevent leakage.

c. Leakage of the anesthetic into the soft tissues is difficult to control and spoils any chance of measuring an ac-

curate dose, while increasing the dose unnecessarily.

d. Bruising of the soft tissues around the puncture will inevitably produce more or less soreness and retard its repair.

It is perfectly feasible to mount the heavy needle on any syringe and so be sure of at least closing the orifice in the bone perfectly. The only point I would raise against that method would be that the dose cannot be so accurately guarded and measured, as the operator must watch both the needle point and the graduations on the plunger. With the ratchet principle, the latter can be ignored, and the operator's attention can be focused solely on the point of injection.

SCOPE OF APPLICATION

As regards the application of the method, this varies according to anatomic conditions. In the upper or lower jaw, it is not generally applicable beyond the first molar, though I have, in favorable cases, used it behind the second molar. The prime factor of the method is the possibility of making the bur perforation neatly and at a right angle to the surface of a bony septum, avoiding the roots of the teeth, and, on the whole, the bicuspid region in either jaw offers most facility for the employment of the intra-osseous injection, though its range of usefulness is not limited to this area. Deeply rooted incisors and cuspids will often fail to respond to infiltration by simple submucous injection in a reasonable time. In the lower molar region, on the other hand, the mandibular injection for blocking the inferior dental nerve is, I think, more generally applicable and successful, though there are unpleasant after-effects sometimes, which make one chary of using it lightly and without regard to the severity of the operation it is desired to perform.

CONCLUSION

I would urge those who have not tried the method, to practice it first in straightforward cases, preferably in the upper bicuspid area, where the perforation into cancellous bone, the essential part of the method, can be readily made. The rest is easy.

A final word of warning: An intra-osseous injection is not a wise proceeding in the neighborhood of a pulpless tooth, where a latent infection may be roused to acute revolt.[1]

1. For a fuller discussion of methods, refer to: Brit. Dent. J., Aug. 16, 1909, p. 861; May 16, 1910, p. 465; Dec. 15, 1910, p. 1201; Dent. Rec., March, 1910, pp. 145-181; April, 1910, p. 246; June, 1910, p. 372; Proc. Roy. Soc. Med., December, 1911; Tr. Internat. Dent. Cong. 1914, pp. 561-567.

THE NONMECHANICAL TREATMENT OF DENTOFACIAL DEFORMITIES*

By ALFRED PAUL ROGERS, M.A., D.D.S., Boston, Massachusetts

EVEN a superficial reading of the history of orthodontia will reveal to the student that, up to the present period, the followers of this specialized branch of dentistry have given more thought to the development of mechanical appliances than to the search for methods of a more fundamental character. As a matter of fact, one may be highly amused by noting the ingenuity and complexity of many of the apparatus invented and actually used in the mouths of children for the correction, oftentimes, of very minor faults. It may surprise some of you, I suppose, when I make the statement that, in the last decade, the profession as a whole has lagged in its opportunity to take advantage of discoveries that would, if properly understood, enable it to rid patients' mouths of many objectionable forms of apparatus. The attitude of the profession of dentistry in general toward orthodontic treatment displays a vast amount of inexcusable ignorance, a great deal of indifference, and even charlatanism in the treatment of malocclusion. It is with these facts in mind that I have consented to read this paper, outlining in a simple way the principles which will enable you to at least simplify your mechanical application, and perhaps lead you into unexpected fields of treatment that may prove a benediction to you as well as to the many children under your care.

Before beginning this outline, I wish to pay my respects to the type of orthodontist who has the courage to preach something other than mechanical force as a means of treatment. While it may be possible to adjust almost any form of malocclusion by the laws of mechanics, it is quite another thing, at the same time, to adjust the physiologic processes so as to rid the individual of some of the important causes underlying the maldevelopment. It is only through a thorough study of biologic, physiologic and psychologic processes that the road may be opened to attain such a result. Therefore, my belief is that these last named collateral subjects should be given more attention than the purely mechanical, for the simple reason that they are vastly more difficult to understand, that the field is broader and that the proper application of these laws needs more intelligence than does the field of mechanics. I believe that our problems will not be solved until the biologist so understands the laws of growth and development that he may be able to control maldevelopment in its inception. Appliances will continue to be an abomination, but a necessary evil, until that time

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comes. With our present knowledge, however, it is possible greatly to abbreviate their evil influence.

This paper should prove of greatest value to you if I follow that method of treatment in the three different classifications of malocclusion that calls for the minimum application of mechanical force and an increased employment of some of the laws of development. It will be well, of course, for you to bear in mind that these ideas are primary in the sense that they are supported by our very limited understanding of the physiologic processes which they employ.

I suppose the simplest form of malocclusion may be found in that classification known as neutroclusion, where there is evidence of arrested development and possibly some crowding of individual teeth out of alinement. If in your imagination you are able to picture such a case, you may, in visualizing its treatment, picture to yourself the adjustment of developmental apparatus of some kind on both the mandibular and maxillary arches. Now, following the principles just set forth, it will be possible, if you think the matter to the end, for you to accomplish the necessary development in both arches by the application and use of one simple appliance, and that appliance of an invisible nature. It makes little difference whether the case you have in mind is one of deciduous development, or mixed, or one in which the permanent teeth are fully erupted: the principles of mechanical application and employment of physiologic laws will be similar. If the operator has not already learned the proper technic of the lingual wire, together with its skilful management, he is debarred from this simple means of treatment until he has attained this knowledge.

Let me say, at this point, that men have come to me with the complaint that they have been unable to obtain results such as have been illustrated, in recent years, by the employment of muscular force, only to reveal to me that they have been trying to combine these principles with an inadequate understanding of the simple mechanical adjunct, the lingual wire. In emphasizing the necessity of the proper construction of the lingual wire, I am prompted by the observation that few men have yet mastered this simple instrument. Writers on this subject have failed to appreciate its possibilities when used in conjunction with the developmental processes of increased functional activity. Briefly, the lingual wire must be constructed in such a way that it rests, when applied to the mandibular arch, just above the gingival border. Then, it must come in contact with each of the individual teeth anterior to its anchorage. Its anchorage must be firm, and, at the same time, the arch wire itself must be easily removable by the operator and easily reapplied. Anterior to the lock, the wire must be provided with loops to increase its field of operation; it must be made of a material which is delicate in its qualities, and it must not be harsh in its operation. The material which I have found best suited for this instrument is 19 gage wire. The anchor bands must be made so carefully that there is no danger of loosening. When the operator has realized these principles and has become able to construct and apply the instrument properly, he is ready to begin the general developmental processes demanded for treatment. The process is

simple, consisting merely in a slight bending of the wire in the direction tending toward the normal shape and size of the mandibular arch.

Removal and reapplication of the wire should occur about once in three or four weeks, and after the first application, the child is taught to contract and relax the temporomaxillary group of muscles many times during each day. A period of a few minutes is set aside each day for this simple exercise. It will not be long before the operator will be rewarded by a demonstration of developmental activity in both arches coincidentally. This process is continued slowly until the arches have attained their normal in shape and size. The details of rotations are easily accomplished by the employment of the simple finger-springs and bands for rotating, but even these are sometimes unnecessary as rotations are frequently corrected during the steady development which takes place under the proper régime. While there is much to say regarding the treatment of neutroclusion, I am prohibited from continuing the subject by the limited time alloted for this résumé.

In taking up the treatment of Class 2, we have a much more difficult problem to consider: It is necessary, first, for the operator to hold within his consciousness a definite idea of the requirements of the case under consideration. Fundamentally, they are as follows: correct form, which implies, of course, correct size for both mandibular and maxillary arches; correct mesiodistal relation, and full development of the teeth to the line of occlusion. In any given case of distoclusion, these fundamentals in development must receive attention in the order in which they have been named. In the beginning, the most adequate and simple method of obtaining the first requirement, namely the development of the arches, may be obtained by the use of the lingual wire, with a few simple attachments, dictated by the special requirements of the case. Mechanical interference through the agency of interfering cusps may be eliminated during the process of the development of arch form. It is not until the sources of interference have been eliminated that it becomes possible for a patient suffering from distoclusion to place the arches in a position of mechanical advantage. As soon as it is found possible for the patient to do so, he is taught the position of mechanical advantage and, at the same time, is instructed in the increased use of his muscles of mastication. The operator will find, much to his surprise, that patients often unexpectedly assume this position of mechanical advantage when interference has been overcome. In these fortunate cases, satisfactory results are quickly obtained. In those which are more difficult, simple forms of inclined planes are sometimes used to assist the patient in finding and maintaining this position, enabling him to carry out his exercise of conscious control with the arches in correct mechanical relation and the muscles functioning in their normal position. The question of the changes which take place in the temporomandibular articulation cannot be discussed in this brief outline. When these methods are properly understood, it is unnecessary to make use of extensive or cumbersome inclined planes during any stage of the treatment. If the student will, at this point, give adequate consideration to the possibilities from the proper use of the

muscular tissues of the face, he will gradually become more skilled and will soon find himself capable of eliminating parts of apparatus which he had formerly thought necessary; or, at least, he should learn to make briefer use of them and thus rid his patient of the necessity of their long continuance. Neither must he forget that, while perfecting his knowledge and skill, he is developing in his patient that invaluable quality of selfdevelopment, and creating also an interest and cooperation which it is often so very difficult to obtain when the patient believes that the entire process of correction is solely a consideration for the operator himself.

It is oftentimes gratifying to notice the development taking place in the faces of children whose cooperation is satisfactory. It sometimes happens that when they become interested in the artistry of their own development, and conscious of the growth of their own flesh and bone into strong and beautiful contour, these young people become directors of their own physical destiny. The results of their efforts often outreach the possibility of any mere operative attainment in beauty and permanency.

Many of those who have attempted these methods have been baffled when they reach a certain stage of treatment in distoclusion, where the posterior teeth are in infraclusion when the arches are placed in their proper mesiodistal relation. Such cases are best treated with small inclined planes on the upper anterior teeth during that period of development when the cuspids and bicupsids are in an active process of eruption. Others have difficulty in treating subdivisions of distoclusion, sometimes called unilaterally distal. In my experience, many of these difficulties disappear when the interference is overcome; and for your possible guidance, I would suggest that you always search for the source of this interference on the side of the mouth opposite to that giving evidence of distoclusion.

I shall now proceed to the consideration of the treatment of mesioclusion, with the idea in mind, as in the former two classifications, of the elimination and brevity of use of mechanical forces and the sufficient and continued use of the muscular forces of occlusion.

I think that we are all conscious of the fact that orthodontists in general have had particular difficulty in maintaining the correction of mesioclusion. Under the method of treatment in which no attention is paid to the conscious control of muscular elements long periods of mechanical retention are found imperative. The operator dreads to remove his retentive apparatus, and is filled with apprehension even then. Some have gone so far as to say that, in their experience, mesioclusion is impossible of retention after correction, and without the employment of the forces of occlusion in normal function, I can easily believe that such statements contain a large element of truth, but with proper understanding and use of the muscles of mastication, correct as to period of duration and time, the statement loses its force and becomes merely a confession of defeat. Of course, it must be understood, in making a statement such as the foregoing, that one must leave out of consideration those cases of mesioclusion which result from the derangement of the pituitary body. I have frequently made the statement that, in this particular form of malocclusion, the muscles

of mastication are weak, and it is a fortunate thing for the operator and the patient when this condition is found to exist. Weak muscles are a particular asset up to a certain stage of treatment; after which, it is necessary that they become strengthened. In the timing of this process of strengthening particularly, the masseter-temporal group is found the key to retention.

A brief word regarding the mechanical application in a case of mesioclusion is at this point necessary. To the mandibular arch is fitted a labial wire, which is anchored securely to as many anterior teeth as will make the lower appliance more or less one of stationary anchorage. Hooks for intermaxillary elastics are placed in the usual position. The maxillary arch is provided with a lingual wire that is in form similar to that described earlier in the text. On the buccal surfaces of the maxillary molar bands, intermaxillary hooks are placed, in such a position as to give the intermaxillary elastic an opportunity to work in the most nearly horizontal position possible. Intermaxillary elastics are then applied, and rarely exceed in number more than one on each side. No attention is given to the development of the muscular tissue until the treatment has progressed to a point where the inclined planes of the opposing teeth are approaching a position of mechanical advantage. When this stage of treatment is reached, the operator must then instruct his patient in the process of conscious development of the masseter-temporal groups of muscles. To those who have not experienced this method of treatment, a gratifying experience is in store, for, as the muscles become stronger and their use is increased to the point where the patient employes several hundred contractions and relaxations a day, rapid progress in the reduction of the deformity will be observed. How long the necessity remains for the employment of the mechanical appliance depends entirely upon the character of the case, but it is safe to say that, in favorable cases, after the inclined planes all have come into normal occlusion, not more than a month may lapse before the appliances can be removed and the treatment continued without apparatus and without retention other than is provided by the strengthened muscular tissues. It is rare to find a case of mesioclusion relapsing after this method of treatment, if the patient continues the exercise faithfully. It is my hope that this brief outline, inadequate as it must be in detail, will serve to further the cause of elimination of objectionable forms of orthodontic apparatus; that it may stimulate the younger men in the profession to continue their study of those forces which have been so neglected in the early development of the science of orthodontia; that it may encourage the older men who have become wedded to old methods of treatment to pause, to reflect and to abandon mechanical appliances of doubtful efficiency.

CONTROL OF DENTAL CARIES BY MEANS OF DIET*

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THE treatment of disease as well as its control depends for success on the removal of the cause. Therefore, if dental decay is to be cured by an altered dietary regimen, it follows that an improper diet is the cause. But such is not the case; so, at the outset of this paper, I am obliged to qualify the hypothesis assigned to me for discussion: that caries can be controlled by diet.

These qualifications are indicated for several reasons; and I propose, therefore to review some of the research work which is being accomplished in the field and to point out its successes as well as its failures. Those of you who heard the discussion of my paper entitled "Diet in Relation to Disease of the Supporting Dental Tissues," previously read before this society, will recall that the points made were:

1. The environment of a cell influences its life. If the concentration of the inorganic salts or if the character of the suspended protein or other organic substances in the surrounding medium is appreciably altered through accident or design, the normal cell development and cell life will suffer interference.

2. Dental disease is not due entirely to local causes but rather is an outspoken expression, in some cases at least, of malnutrition, especially as far as calcium and phosphorus metabolism is concerned.

In this paper, your attention is invited, first, to a comparison between the various factors entering into the etiology and control of dental caries, and, secondly, to a discussion of experiments pertaining to the relation between diet and decay.

Ever since the time of W. D. Miller, in fact even before, attempts have been made by different investigators to discover the micro-organism responsible for dental caries. In spite of the many endeavors made to fasten the responsibility of this disease entirely upon the oral flora, the attempts up to the present time have been unsuccessful. You will recall that Miller said, in 1883[1] and again in 1892, that he was not prepared at that time to state positively that dental caries was caused by micro-organisms; but what he did say was that micro-organisms played a large part in the etiology. This statement holds true today as then.

The so-called chemicoparasitic theory does not correlate all of the clinical facts; for example, it does not explain the comparatively rare condition of "immunity." Therefore, the hypothesis of Miller is limited to only a few

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

1. Miller, W. D.: Agency of Micro-Organisms in Decay of Human Teeth, Dent. Cosmos, 26: 337 (Jan.) 1883.

observed clinical and laboratory phenomena associated with this disease.

Bunting's recent report[2] on his bacteriologic researches dealing with caries stresses several facts, one of which is that the organisms commonly associated with dental decay exhibited, under

Fig. 1.—Dental caries of second mandibular molar involving a large portion of the root.

various cultural conditions, a rather diverse form. They may assume rodlike characteristics; or they may have the appearance of cocci, depending in part on the kind of culture mediums and the age of the culture. This is, of course, a well-known phenomenon with certain other organisms, and pleomorphism has been emphasized by earlier investigators, especially by Clarke,[3] in 1924.

The very fact that bacteriologists have not been satisfied with their own results has led some of us, interested in other lines of endeavor, to attack the problem of etiology from another standpoint. There is no doubt that we must consider in this connection at least five factors in etiology. First, there are those which may be grouped under the general term of anatomic causes. In this, we include, naturally, the position of the teeth, whether or not they are normal in the arch in relation to occlusion and contact; also, the presence

2. Bunting, R. W.: Dent. Cosmos, 68: 931 (Oct.) 1926.

3. Clarke, J. K.: Lancet, 1: 230, 1924.

of faults of development such as are considered under the term of hypoplasia.

The second group, the bacteriologic have also to do with local factors. The confirmatory evidence of W. D. Miller's work, which has been offered by Percy R. Howe,[4] Kligler, McIntosh, James, Lazarus-Barlow,[5] Clarke, Bunting, all point to the fact, first, that a threadlike organism, as typified by promptly sets up housekeeping. This is the acid-forming organism which is responsible for the decalcification of the tooth structure.

It is at this particular stage of development that arrested caries may occur. An area of arrested caries is, as you know, characterized by a small dark-colored spot. The explorer slides over this without "catching." This

Fig. 2.—Lingual half of tooth lost from caries.

Cladothrix placoides and *Leptothrix buccalis*, fastens itself to some convenient tooth surface. This is the commencement of the bacterial plaque. Within a short time, a new organism, *Bacillus acidophilus*, finds this plaque a suitable place for growth, and condition is comparatively rare, and the factors responsible for the apparent "recalcification" are not known. It has been determined, however, that such an area is comparatively free from microorganisms.

To continue with the histogenesis of caries, may I recall that the dissolution of enamel proceeds at varying speeds. In some mouths, the process goes apparently very rapidly and in others, rather slowly. One explanation for this phenomenon is that we may assign to

4. Howe, P. R., and Gillette, Helen H.: Studies on Dental Caries, J.N.D.A., 4: 997 (Sept.) 1917.

5. McIntosh, J., James, W. W. and Lazarus-Barlow, P.: Investigation in the Etiology of Dental Caries, Brit. J. Exper. Pathol., 3: 138 (June) 1922.

the saliva certain properties which may favor or impede bacterial growth. At a later time, with the invasion of dentin, a new organism appears, one which is capable of dissolving the organic tooth matrix. Here, a proteolytic bacterium starts *Bacillus putrificus*. It occurs in symbiotic relationship with *Bacillus acidophilus* and together they gradually form a cavity in the tooth. Coincident with the formation of this cavity, various strains of streptococci begin to appear. These progress down the dentin tubules toward the pulp. From here on, the course of infection may be of such a nature that secondary dentin is formed, thus delaying, for the time being at least, the further destruction of tooth substance. On the other hand, the infection may cause rapid pulp degeneration and death, with the subsequent development of apical abscess, either acute or chronic.

You will note that the bacteriologic as well as the anatomic aspects are fairly well worked out, but neither explain all of the clinical facts.

The next three factors which may be considered in the etiology of dental caries deal more particularly with calcium metabolism. Included in this category are the saliva, the glands of internal secretion (the so-called endocrines) and the diet. This group of factors contains at least one which links up the local with the systemic. Saliva unquestionably exerts a local effect, by providing a favorable environment for bacterial activity. Its concentration is fairly constant, except under conditions of mastication, sickness, emotional stress, fatigue or hunger. Since it is manufactured

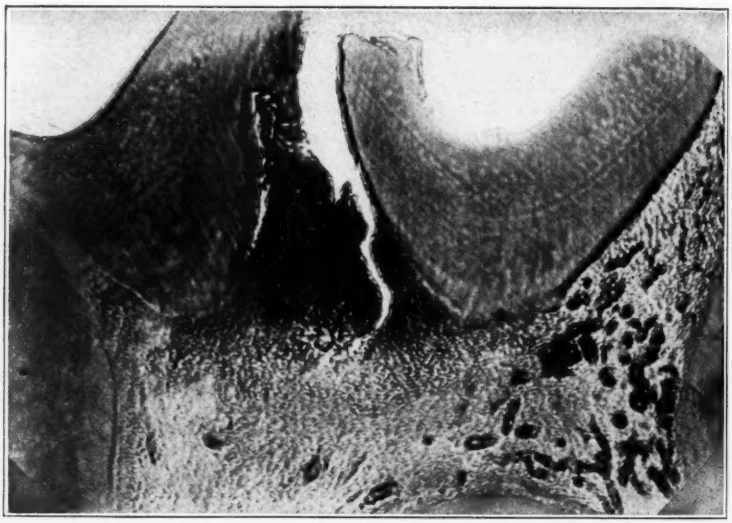

Fig. 3.—Carious dentin, cavity formation and pulp infection.

partly from blood serum, it possesses some of the characteristics of this fluid. Indeed, the inorganic salts found in both saliva and blood serum are similar; and the salts impart certain properties to saliva which are highly important from the dental standpoint. During illness, oral stagnation often occurs, and this decrease in salivary flow favors localization of bacteria and their subsequent growth. It is not my purpose to discuss in detail oral hygiene, saliva or the much maligned and certainly little understood endocrines, but rather to present a few new facts dealing with the effect of diet on dental decay. The results which have been obtained are significant, pointing to a definite relationship between the two topics.

This is especially true of the research reported by Mrs. Mellanby, who as the result of experimental work on puppies, has presented data which indicate that food, after absorption, plays an important part both in influencing the calcification of the teeth and in altering the reaction of erupted teeth to harmful stimuli. Vitamin D was found to have a greater effect than vitamin A in this regard. Although the two vitamins have a similar distribution in nature and possess the same properties as to solubility, etc., their biologic reactions are apparently different.

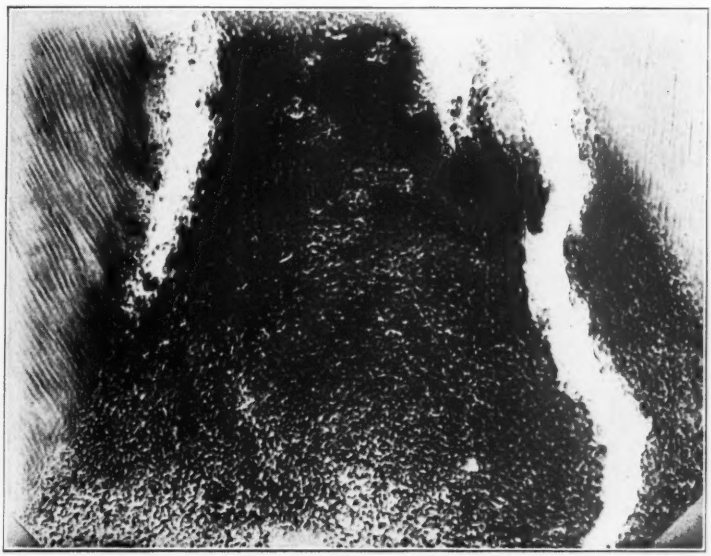

Fig. 4.—Carious dentin in the center and normal dentin on each side.

Furthermore, Mrs. Mellanby's examination of human carious deciduous teeth pointed to the fact that they are frequently of defective structure and are thus more susceptible than otherwise to caries. This applies more particularly to hypoplastic enamel, because some of the defective teeth examined

were not carious. The explanation for this lies in the fact that secondary dentin was found deposited in such a place and manner that the carious processes were inhibited. This again brings us face to face with the fact that arrested caries is an unexplained phenomenon.

Mrs. Mellanby's present experiment deals with tuberculous children between the ages of 6 and 12 who were placed on three different types of diet. The first diet consisted of a large amount of calcifying vitamin but no oatmeal. The second diet contained "some calcifying vitamin" and 50 gm. of oatmeal daily. The third diet was intermediate as far as the calcifying vitamin was concerned, but had no oatmeal. The duration of the experiment was from 25 to 28 weeks. Although records of mouth and dental conditions were made, Mellanby and Pattison[6] themselves acknowledge that errors in charting occurred.

It would seem that if hypoplasia is always present in carious teeth, as Mrs. Mellanby and Pattison contend, a more careful microscopic examination should have been made. In fact, routine ground sections of all hypoplastic carious teeth would be the only acceptable proof which these authors could present. They believe that they are justified in concluding that resistance to dental caries of erupted and defectively calcified teeth of children can be influenced by certain constituents of the food after its digestion and absorption;

Fig. 5.—Pulp stone near opening of pulp canal.

6. Mellanby, May, and Pattison, C. L.: Some Factors in Diet Influencing the Spread of Caries in Children, Brit. Dent. J., 47: 1045 (Oct. 1) 1926.

and, secondly, that those dietetic substances which have been found to produce in animal experiments perfect and imperfect teeth are those which also raise or lower, respectively, the resistance of the erupted teeth to caries.

As I have stated in a previous paper on this subject,[7] it is "difficult to evaluate dietary deficiency diseases in lower animals in terms which are applicable to man; in fact, it is somewhat risky to generalize even, from different animal experiments." While the researches of Mrs. Mellanby cited above are exceedingly interesting and suggest many possiblities, it is to be pointed out that a closer study must be made as to the effects produced by vitamins A and D in both human and lower animals before the generalities proposed by Mrs. Mellanby can be accepted.

There is another factor connected with the experiment which is worthy of note. It is well known that the oat kernel contains protein which is deficient in certain necessary amino-acids. This fact, also dealt with at length in my first paper,[7] suggests this question: What influence will such an "unbalanced" protein exert in a diet already deficient in other respects? And how far is Mrs. Mellanby justified in attributing her results to vitamin deficiencies rather than to protein unbalance?

Another point which is certainly important is this: What dental application

Fig. 6.—Delayed formation of apical portion of molar root. The entrant capillary passes through the peridental membrane into the pulp.

7. Marshall, J. A.: Diet in Relation to Disease of the Supporting Dental Tissues, J.A.D.A., 14: 2207 (Dec.) 1927.

can be made of an experiment of approximately six months' duration on unhealthy subjects? And, furthermore, is one justified in basing conclusions on experimental results obtained during this relatively short period of time, without taking into consideration the individual's previous environment and state of health? It will be recalled that these children were tuberculous; and it has been established that calcium metabolism in tuberculosis is abnormal. The influence, therefore, which bone tuberculosis may have on the whole phenomenon of calcium absorption and bone ossification is difficult at this time to determine.

The *British Dental Journal*[8] has taken issue with Mellanby and Pattison over some of the statements which they make in the description of their experiments. The editorial in question is objectionable to Mrs. Mellanby, partly on account of this sentence: "We do not think the work carried out by Mrs. Mellanby has in any way supplanted the work of Miller." Mrs. Mellanby points out that Miller's teachings were acceptable as far as they corresponded with the available knowledge of his time; but, today, on account of the great advances in physical, chemical and biologic sciences, new facts have been found, and therefore modified theories must be used in explanation. She says there is little doubt that the immediate cause of caries "is the result of bacterial decomposition of foodstuffs on the teeth." However, as she points out, this is obviously only part of the story.

During the past two and a half years, other experiments have been conducted at the University of California which deal somewhat with this question. Originally, it was the object to determine whether or not the same conditions could be produced in rats, by deficiencies in diet, as were reported on dogs in 1923. This was not proved, but, instead, a much more interesting development occurred which had been hinted at by McCollum and Grieves,[9] and for which I am offering additional proof.

There are at the University laboratories large colonies of rats which are being maintained on certain special diets. Some of these diets are adequate in every respect except that they do not provide any vitamin A. Others lack vitamin D, or E, and so on. After periods of time, varying from eight months to a year and a half, animals which have been subjected to a vitamin-A-deficient diet gradually develop a dental condition which is similar in many respects to clinical dental caries. In some instances, the decay of the teeth has gone so far that the pulp has become invaded. In other cases, the infection has produced an apical abscess. I have specimens to show the invasion of both crown and root portions of the tooth.

An especially interesting communication by Macomber[10] of Harvard sheds additional light on this point. His work dealt with diets deficient in lime instead of vitamins, and he clearly points out that "Calcium is the most important of the inorganic elements in the animal body. In the adult, it furnishes 2 per cent of the total weight and 99 per

8. Brit. Dent. J., editorial, Oct. 1, 1926.

9. McCollum, E. V.; Simmonds, Nina; Kinney, E. M., and Grieves, C. J.: Relation of Nutrition to Tooth Development and Tooth Preservation. Part I, Bull. Johns-Hopkins Hosp., 33: 202 (June) 1922.

10. Macomber, Donald: J.A.M.A., 88: 6 (Jan. 1) 1927.

cent of this is found in bones and teeth. It is present in all tissues including the blood, and without it, life as we know it would be impossible." Macomber's experiments have a particular dental application, for he reports likewise that the molar teeth of the rat are decalcified and become carious as a result of calcium-deficient diets.

The rat is, as you know, monophyodont, but nevertheless is provided with two types of teeth. The incisors constantly erupt throughout life and grow from a persistent pulp; the three molars, upper and lower, right and left, do not. It is only the molars that are affected by these deficient diets. A close laboratory record has been kept of all these animals from birth to death, this record including the date of birth, the parentage and, in many cases, a greater part of the geneological tree. In addition, there is also a report of the first clinical evidences of avitaminosis—scraggly hair; development of corneal ulcers and lingual abscesses, and decreases in growth weights. I have described elsewhere[11] the diets and the technical details dealing with the preparation of the microscopic specimens. Suffice it to say, therefore, that both decalcified and ground sections were studied conjointly throughout the course of the experiment. This, in itself, is a new phase, and the additional work necessary to carry out this portion of the experiment has been entirely justified by the results which have been obtained. The laboratory reports of several of these rats may be interesting in that they are indicative of the type of lesion which is found:

Specimen 297: Female, 435 days old, on a diet of extracted casein, cornstarch, McCollum salt mixture, and lard plus yeast, from weaning until death. This animal is approximately equivalent in its life cycle to a human being 36 years old. At necropsy, the upper right first molar was decayed to the gum line. On microscopic examination, it was found that the pulps had undergone degenerative changes to such an extent that necrotic areas were clearly shown. In other portions of the pulp, intense inflammation was present. The odontoblasts were not demonstrable.

Specimen 308: Female, 375 days old, from weaning until death on the same diet. This female is equivalent in its life cycle to a human being 31 years old. At necropsy, there was marked caries of the first and second maxillary molars.

Specimen 226: Male, 134 days old, equivalent in the life cycle to a human being, 22 years old, on the same diet from weaning until death. Neither the examination at necropsy nor the subsequent histopathologic study of tissues showed any definite carious areas. However, the pulps in these teeth were greatly inflamed throughout, and the blood vessels distended to unusual size.

When the bone of older animals on a low vitamin A diet is compared with the bone of 31-day-old animals, also on a diet low in vitamin A, it will be found that there is apparently no increase in the degree of ossification. When these animals on a diet low in vitamin A are compared, age for age, with normal animals, the differences in ossification are very marked. One other point deserves mention in this connection, namely, the relatively small amount of normally ossified bone. In its place are abnormally large marrow spaces or fibrous connective tissues.

One of the criteria of animals on diets low in vitamin A is the manner in which they lose weight. This has been shown in several charts. For ex-

11. Marshall, J. A.: Dental Caries and Pulp Sequelae Resulting from Experimental Diets, J.A.D.A., 14: 3 (Jan.) 1927.

ample, in Figure 35 (page 26) of my article on "Dental Caries and Pulp Sequelae Resulting from Experimental Diets," there is represented an average weight of normal females and females on diets low in vitamin A, computed weekly. These normal weights rise without showing any great lag or plateau. When charts showing growth weights of normal animals are compared with those of animals on a diet low in vitamin A, there is a marked difference. For example, the rise after the twentieth week is much slower, and, with a continued dietary restriction, the weight drops quickly to less than half that of the normal. It may be said in passing, that not all of the animals on diets low in vitamin A show the same growth deficiencies. This is an example of one of the puzzles and apparent discrepancies which are encountered in dietary work. However, the experimental work is advanced to such a stage by the study of a large group of animals that the following conclusions may be safely offered:

Rats placed on diets deficient in vitamin A develop lesions similar to dental caries apparently only after maturity has been reached. The lesions so produced are more like those found in adult man than in the child or adolescent. In the more advanced cases, pulp lesions have been demonstrated, such as abscess and pulp calcification, these occurring in teeth both with and without dental caries. Although the growth curves, for experimental animals, indicate on an average the typical vitamin A avitaminosis, all the animals do not respond to the same degree to these deficient diets. The lesions which have been demonstrated in rats are entirely dissimilar to those which have been previously reported on dogs, for neither enamel nor dentin hypoplasia has been found in the rat.

It is apparent, in summarizing the work so far reported on diets, that the control of dental caries by this means will probably not come in this generation nor in the next, but possibly in the third. By that, I mean that it will take this length of time first, to solve the complex problems of calcium metabolism, secondly, to apply the solution of those problems to human nutrition, and, finally, to educate the public to follow out the application. Even then, I doubt whether dental caries will be entirely controlled. It is a problem in which diet plays only a part. The local conditions as controlled by saliva and as modified by the oral flora are still important factors in the etiology.

HISTOLOGY OF THE ENAMEL LAMELLAE AND TUFTS*

By B. ORBAN, M.D., Chicago, Illinois

BODECKER was the first to describe the enamel lamellae. He stated that these consist of bundles of organic substance extending from the surface of the enamel up to the amelodentinal junction. After Bödecker, many investigated the enamel lamellae, and most found that they are made up of uncalcified enamel substance.

Von Ebner was of the opinion that they are uncalcified interprismatic substance, and Walkhoff thought them to be uncalcified prisms. Other authors have described these formations as cracks which occurred during the preparation of the sections.

Sometime later, Gottlieb occupied himself with the question of organic substances in the enamel and stated that the enamel lamellae and tufts are not cracks but organic, incompletely calcified enamel substances. Gottlieb was able to demonstrate that, after the complete loss of enamel by decalcification, the enamel lamellae remain. This could only be possible if the lamellae are organic substances and not cracks, which would disappear in the course of the decalcification.

At the same time, Gottlieb found that some of the lamellae do not end at the enamel-dentinal junction but penetrate for some distance into the dentin. It is important to know that Gottlieb stated that the lamellae and tufts are clustered more densely on the interproximal surfaces than on the other surfaces. This fact seems to Gottlieb to be of great importance in the development of caries. Some years later, Gottlieb found cracks in the enamel of a human tooth germ into which the cells of the outer epithelium layer had grown. (Fig. 1.) At the same time, he observed that the outer part of the enamel lamellae may become hornified, like enamel cuticle. He asserted that the lamellae originate in the following way: crevices in the enamel arise into which the outer enamel epithelium grows, forming the lamellae. If the outer enamel epithelium becomes hornified, the same thing can take place in the outer part of the lamellae. Gottlieb also thought that the hornifying of the enamel cuticle and of the outer part of the lamellae was of advantage

*Read before the Section on Bacteriology, Pathology and Diagnosis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

*This investigation was made in the Histologic Laboratory (superintendent, Dr. B. Gottlieb) of the Dental Institute of the University of Vienna (director, Prof. Dr. Weiser).

for the teeth, because the hornified layer prevented the progress of caries.

After a time, I occupied myself with these questions and came to the following conclusions: There are two kinds of lamellae. One consists of badly calcified enamel substance, the other of penetrate to the enamel dentinal junction or not so far, but never can reach into the dentin. Figure 3 is a higher magnification of a part of the lamella illustrated in Figure 2. We see in the normal enamel structure loosened enamel rods which are badly calcified.

Fig. 1.—Cracks (*a*) in the enamel (*b*) in which the surrounding tissue (*c*) grows in.

tissues which have grown into crevices in the enamel from the surrounding tissue. My further investigations showed that there are still some details the knowledge of which are necessary for the complete understanding of the nature of the enamel lamellae.

Figure 2 illustrates the first kind of lamellae, consisting of poorly calcified substance. This kind of lamella may

I infer that these lamellae originate in the following way: After the whole enamel substance is complete but calcification is not yet finished, through pressure in the tissues of the jaw, microscopic tears and disorganization of the rods takes place, along which the later calcification does not take place, because the connection between the rods is loosened. The poor calcification of

the lamellae cannot be caused by any general nutritive disease, such as rickets, because if this were the case, the incomplete calcification would not be vertical to the surface of the enamel, but parallel to it as the stripes described by Retzius. (Fig. 4.)

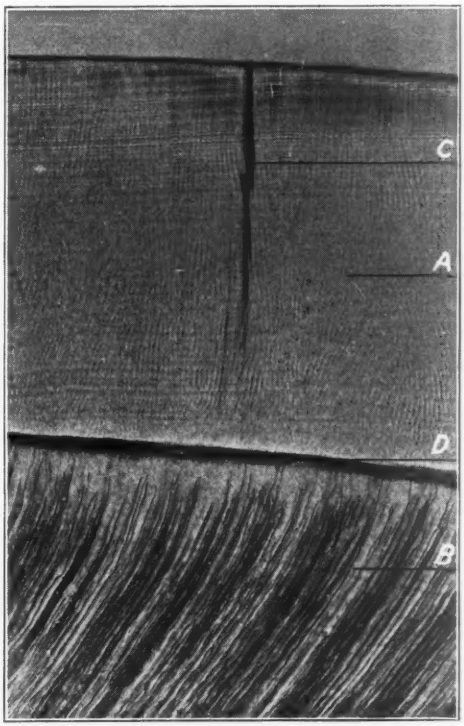

Fig. 2.—A lamella (*c*) consisting of poorly calcified enamel substance. *a*, enamel; *b*, dentin; *d*, amelodentinal line. The lamella does not extend up to *d*.

The second kind of lamellae consists of remains of surrounding tissues, which grow into the crevices of the enamel. What substance the lamellae consists of is determined by the kind of tissue lying opposite the crevices. If opposite a crevice there was epithelium tissue from the outer epithelium layer, the lamellae can become hornified as can the enamel cuticle. The tears in the enamel layer seem to arise when not only the outer but also the inner epithelium lies on the surface of the enamel. Generally, the lamellae arise not only from the outer but also from the inner epithelium. The former is capable of hornification, the latter is not. So the lamellae can consist of two parts. (Fig. 5.) The inner part (*b*)

is an organic substance arisen from the inner epithelium. The outer part (*d*) originates from the outer epithelium layer and can become hornified. We can see in the picture the hornified cuticle (*c*) on the surface of the enamel (*e*), which has disappeared by decalcification. The cuticle can be followed to the entrance of the lamella so that the outer part of the lamella is formed by a double layer of cuticle.

Already in the picture we can observe a wedge-shaped crevice (*d*) in the dentin in the continuation of the lamella. That is the dentinal part of the lamella. This statement of Gottlieb's was disputed by a number of authors, who asserted that these crevices were artefacts. I have been able to prove that Gottlieb's opinion about the dentinal part of the lamellae is correct. That it was disputed is due to the fact

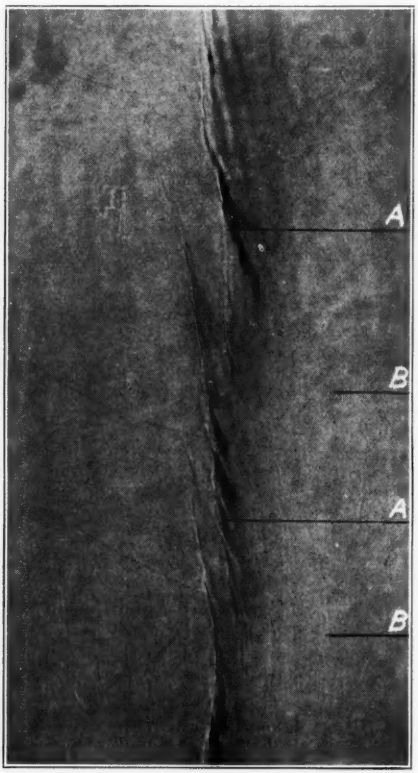

Fig. 3.—A part of the lamella of Figure 2, more highly magnified. *a*, poorly calcified enamel substance; *b*, well-calcified enamel.

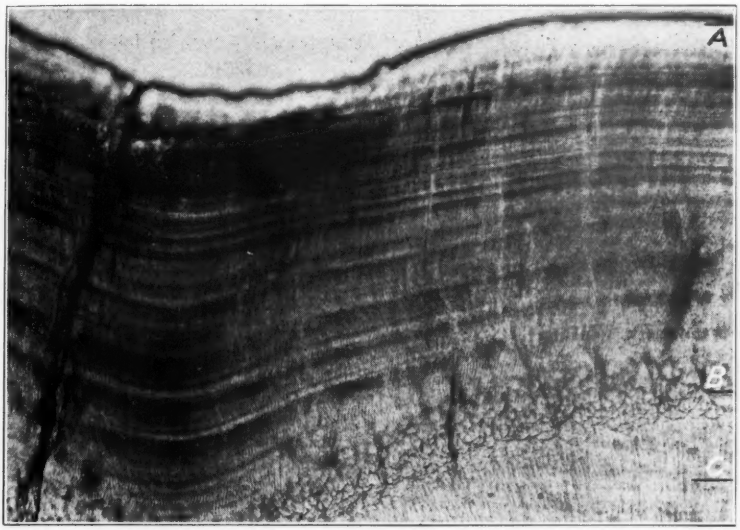

Fig. 4.—Stripes described by Retzius. *a*, a surface of the enamel; *b*, amelodentinal junction; *c*, dentin.

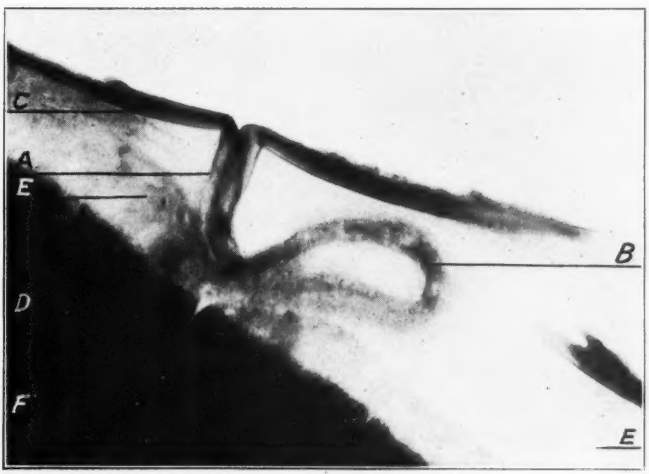

Fig. 5.—The lamella, consisting of two parts; *a*, hornified outer part; *b*, unhornified inner part; *c*, hornified enamel cuticle; *d*, dentinal part of the lamella; *e*, enamel; *f*, dentin.

that the authors did not recognize the difference between the two kinds of lamellae as I now do.

The first kind of lamella that I mentioned (Figs. 2-3) cannot have a dentinal part, but the second kind of lamellae can, as is shown in Figure 6, a lamella near the amelocemental junction. *a* is the epithelium attachment; *d*, the enamel. Between epithelium and enamel, we can observe the hornified cuticle *b*. At *c*, we see the lamella with a tear in the center. At *f*, we can follow the lamella into the dentin *e*. We observe not only a crevice in the dentin but also a part of the lamella reaching into it.

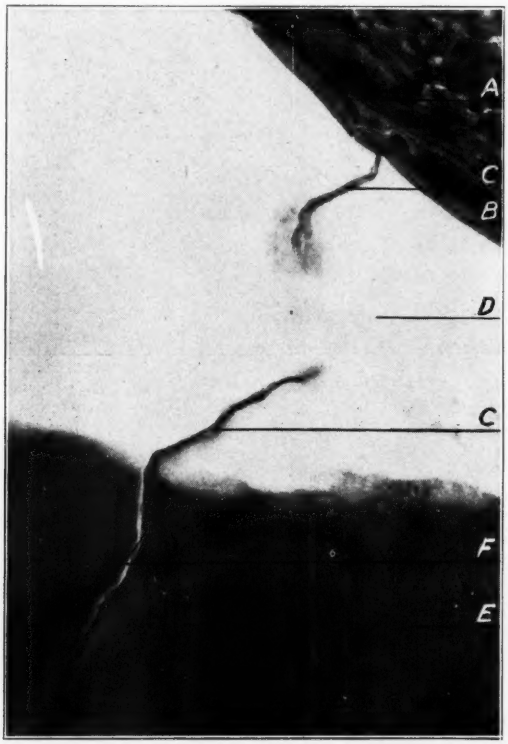

Fig. 6.—Lamella with dentinal part: *a*, epithelium attachment; *b*, hornified cuticle; *c*, lamella; *d*, enamel; *e*, dentin; *f*, dentinal part of lamella.

I have made the statement in the beginning that this second kind of lamella consists of tissues which have grown into crevices in the enamel and also dentin. These lamellae can consist of various kinds of tissue according to what tissues lie opposite the crevices.

If the cells of the inner epithelium layer lie opposite a crevice, the lamella becomes an organic band, as seen in Figure 7. In this case, cells of the outer epithelium layer either have not grown into the crevice or have not become hornified. I found also that if connective tissue lies opposite the enamel and a crevice arises, the connective tissue grows into it and builds up the lamella. Connective tissue can produce cementum or bone. We see in Figure 8 an enamel drop on the root of a human molar. The enamel epithelium has been destroyed. Connective tissue lies on the surface of the enamel drop. We observe some of the lamellae crossing the enamel. A higher magnification (Fig. 9) shows a lamella. We can follow the cementum, covering the surface of the enamel drop and reaching into the enamel as a cementum lamella. This lamella reaches also into the dentin.

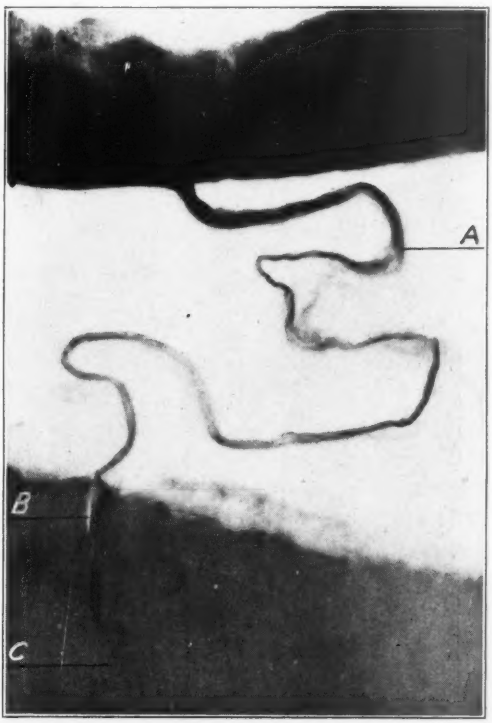

Fig. 7.—Lamella consisting of an organic band (*a*). *b*, dentinal part of the lamella; *c*, dentin.

As we have seen, there are morphologically two kinds of lamellae. One

consists of poorly calcified enamel substance, the other of tissue which has grown into the crevices in the enamel from the surrounding tissues. I am inclined to think that, in their development, there are only gradual differences. The first kind originate if, during the development of the enamel, the continuity of the not yet properly calcified enamel substance is loosened by pressure. If the causes which lead in one case to tears in the continuity of the enamel rods are stronger, crevices result, and the surrounding tissue grows in and constitutes the second kind of lamella, which may consist of organic bundles, may become hornified or may consist of cementum, this depending on what kind of tissue lies opposite the crevices.

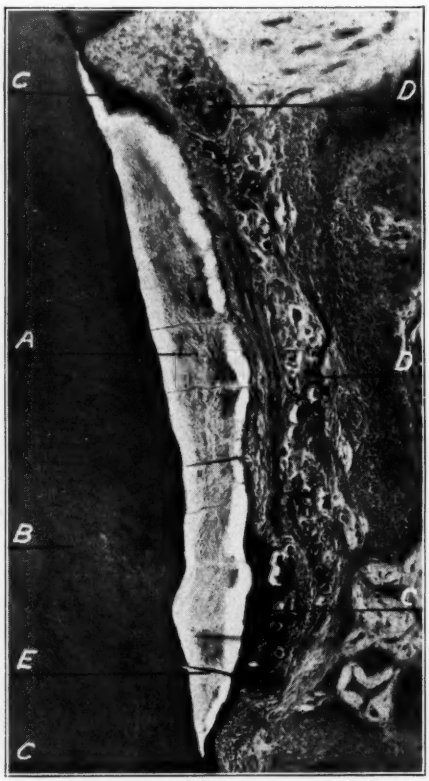

Fig. 8.—Lamellae in the enamel drop. *a*, enamel; *b*, dentin; *c*, cementum; *d*, destroyed epithelium; *e*, lamella.

Regarding enamel tufts, I was able to observe that the tuftlike shape of

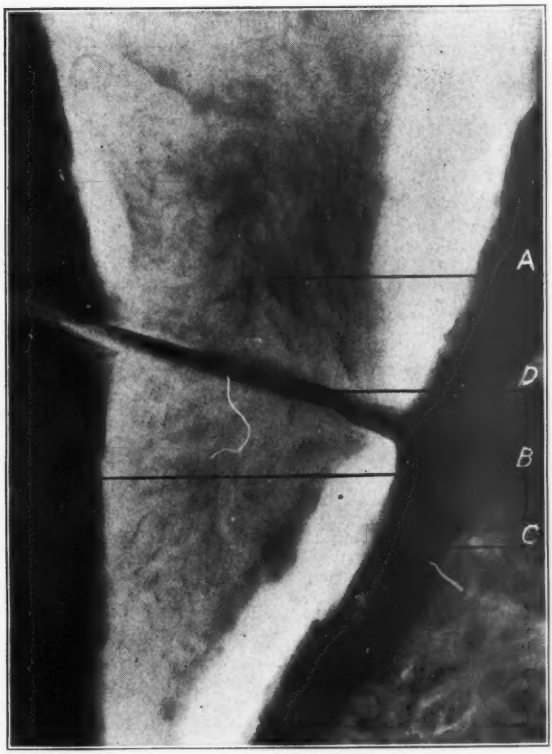

Fig. 9.—Higher magnification of the lamella (*e*) in Figure 8. *a*, enamel; *b*, dentin; *c*, cementum on the surface of the enamel drop; *d*, lamella consisting of cementum.

Fig. 10.—"Tufts" in the enamel (low magnification). *a*, enamel; *b*, dentin; *c*, tufts.

them is only an optical illusion. If we examine a tuft under low magnification, we see the tuftlike form (Fig. 10); but if we regard them under high magnification, we see not a tuft, but only one fiber of the "tuft." This is shown in Figures 11 and 12, which show different fibers of the same tuft. If we move the microscope closer we can always observe one fiber after another, but only one fiber at a time. In the following figures, I can demon-

Fig. 11.—"Tufts" (high magnification). *a*, enamel; *b*, dentin.

Fig. 12.—The same "tufts" as in Figure 11 in a deeper plane of the same section. *a*, enamel; *b*, dentin.

strate diagrammatically the tufts as they are. Figure 13 shows the tuft under

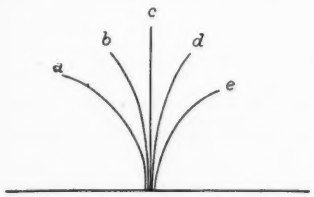

Fig. 13.—Diagram of a "tuft" (low magnification). *a-e*, fibers of the "tuft."

low magnification. Here we can see the tuftlike form. In Figure 14, we can observe the fibers of this tuft under higher magnification. We can see only one fiber at a time—to see another one the microscope must be moved. In Figure 15, the tuft is to be seen drawn in perspective.

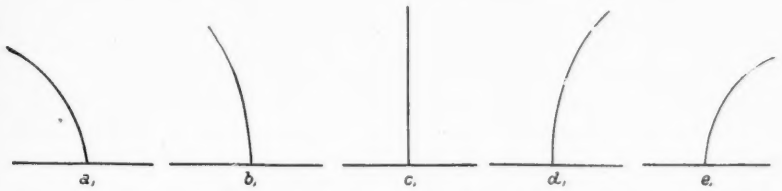

Fig. 14.—Diagram of the same "tuft" as in Figure 13 (high magnification). We see not a tuft but one fiber at a time.

SUMMARY

There are morphologically two kinds of lamellae. One consists of poorly calcified enamel substance, the other of tissue which has grown into the crevice from surrounding tissues.

In their development, there are only gradual differences. The first kind originate if, during the development of the enamel, the continuity of the still incompletely calcified enamel substance is broken by stresses. If the stresses reach a certain degree of intensity, crevices result, and the surrounding tissue grows in and constitutes the lamellae.

The tuftlike shape is an optical illusion arising from the projection onto one plane of incompletely calcified enamel substances (fibers) lying in different planes.

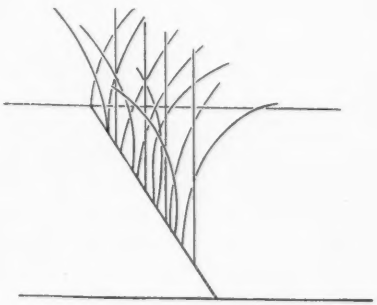

Fig. 15.—Perspective drawing of a tuft.

RADIOGRAPHIC AND HISTOLOGIC EVIDENCE OF THE FUNCTIONAL ADAPTATION OF THE ALVEOLAR PROCESS*

By HUGH W. MacMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

THE chief application of the roentgen ray in dentistry is in the diagnosis of pathologic processes in the bone adjacent to the teeth. The criterion by which these pathologic processes are judged is the appearance of the normal. The term normal as used in this paper refers to the form characteristics of the compact and cancellous bone adjacent to the teeth, fully developed under the influence of functional activity. As the correct interpretation of the dental film depends on an appreciation of the normal, an attempt will be made at the start to describe the form characteristics of the normal alveolar process.

A normal adult alveolar process is found only in specimens or patients whose occlusal surfaces show degrees of wear. Functional stimuli are transmitted to the investing bone only by stresses received on the occlusal surfaces—not by massaging pastes, toothbrushes, gum rubs, corrugated finger cots or suction disks. As a result of the increased density of the alveolar process induced by these occlusal stresses, there will be an increased resistance to the roentgen ray, which is the first diagnostic sign of a normal alveolar process.

Viewing a radiographic film of the normal mandibular molar region of a young adult reveals the fact that the cancellations of the bone forming the upper edge of the alveolar border are of the close meshed variety, resembling compact bone. In the region of the middle third, the trabeculae are farther apart, the bone being wider meshed in character as the apical region is approached. The region of the apical third may be almost devoid of surrounding bone except for some shadow-like lamellae which apparently support the capillaries of the nutrient canal.

The compact nature of the upper edge of the alveolar border is explained by the application of the law of bending stress which rules that "to resist bending moment stresses most effectively the material should be as far from the neutral axis as possible."[1] In further explanation, bending stresses produced in the body of the mandible by forces exerted in the incisor region stimulate a filling in of the cancellous spaces of the upper edge of the alveolar border in

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

1. Koch: Laws of Bone Architecture, Am. J. Anat., p. 269, 1917.

the molar region, resulting in greater density of bone, in conformance to the law as stated above. This arrangement is much more apparent in the histologic study of thin cross-sections of this region of the mandible.

A knowledge of the normal form characteristics of that part of the alveolar process known as the lamina dura is fundamental in the diagnosis of pathologic disturbances in this region. Functionally, the lamina dura affords an attachment for the fibers of the peridental membrane and, through them, transmits the forces of mastication to the supporting bone beyond. The compactness of the walls of the normal alveolus may be likened to the increased density of those parts of the remaining skeleton which afford muscle attachments. As the contour and density of these muscular attachments vary with the forces exerted on them, so the lamina dura varies in thickness and density with the amount of compressive and lateral stresses exerted in mastication. In the normal mandible, there is no sharp demarcation between the lamina dura and the bone immediately adjacent. In fact, the lamina may not

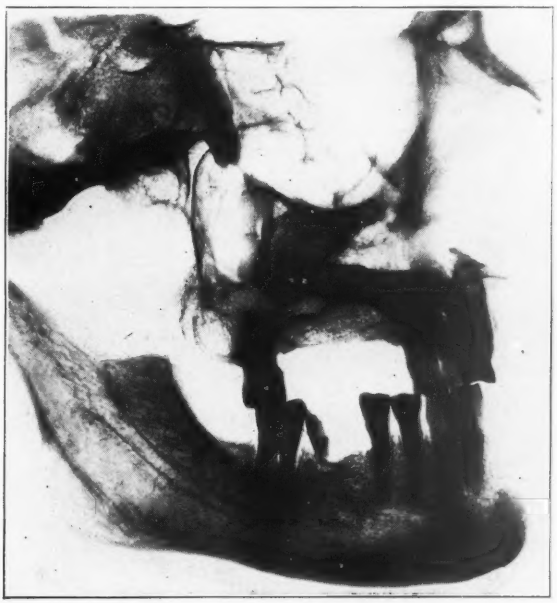

Fig. 1.—Functional adaptation of the alveolar process to functional requirements. The degree of wear exhibited by the occlusal surfaces, the increased closeness of spacing of cancellous tissue, the superimposition of the lamina dura around the maxillary and mandibular molars, the rebuilding of the alveolar process following tooth extraction, and the physical signs of disuse atrophy in the mandibular second bicuspid region are evident.

exist as such on the negative owing to its superimposition by the close meshed compact bone which surrounds the socket. This is more noticeable in the region of the gingival third where bending stresses are added to compressive stresses.

The lamina dura has been described by the writer of a recent book on radiographic diagnosis as a "thin even white line."[2] This definition does not apply to the "normal" structure just described. Rather it belongs to the field of pathology. The "thin even white line" is the pathognomonic sign of disuse atrophy. general appearance of the bone is that of disuse atrophy. Whitman, in discussing atrophy of bone, comments on this condition as follows: "In the X-ray negative such atrophy is indicated by a loss of clearness in outline which is replaced by a peculiar blur, resembling closely the infiltration due to disease."[3] Another statement from Whitman of peculiar significance in the treatment of periodontoclasia for patients with this type of alveolar process is that "these nutrutive changes explain the delay in recovery after apparently slight injury or disease. . . ."[3] Disuse

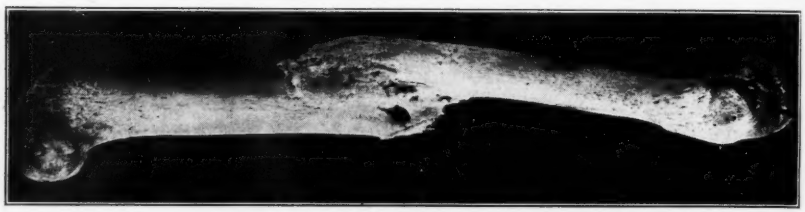

Fig. 2.—A healed overriding fracture of the femur, which was sectioned to study the character of the bone uniting the two fragments.

In contradistinction to the normal form characteristics of the alveolar process as described in the previous paragraphs, the radiographic appearance of the alveolar process of the average patient does not present this appearance. Worn occlusal surfaces are not characteristic of the modern epicure. The bone is much less resistant to the rays. The graduation in the spacing of the cancellous tissue from the alveolar border to the region of the apex is proportionately the same except that the cancellations are of a wider pattern and the trabeculae are hazier in outline. The atrophy is the picture more often present in the modern radiographic examination.

The laws of bone mechanics as applied to the rebuilding of the normal alveolus of a mandibular second molar after extraction are directly related to radiographic interpretation. The bone in the immediate vicinity of the teeth adjacent to the alveolus meets the changed conditions of stress created by loss of the contact point by thickening of the lamina dura and by an increased closeness of spacing of the supporting bone mesially to the third molar and distally

2. Greenfield, A. L.: Interpretation of Dental Radiographs, Rochester: Ritter Dental Mfg. Co., p. 2, 1926.

3. Whitman: Orthopedic Surgery, Philadelphia and New York: Lea & Febiger, p. 234, 1919.

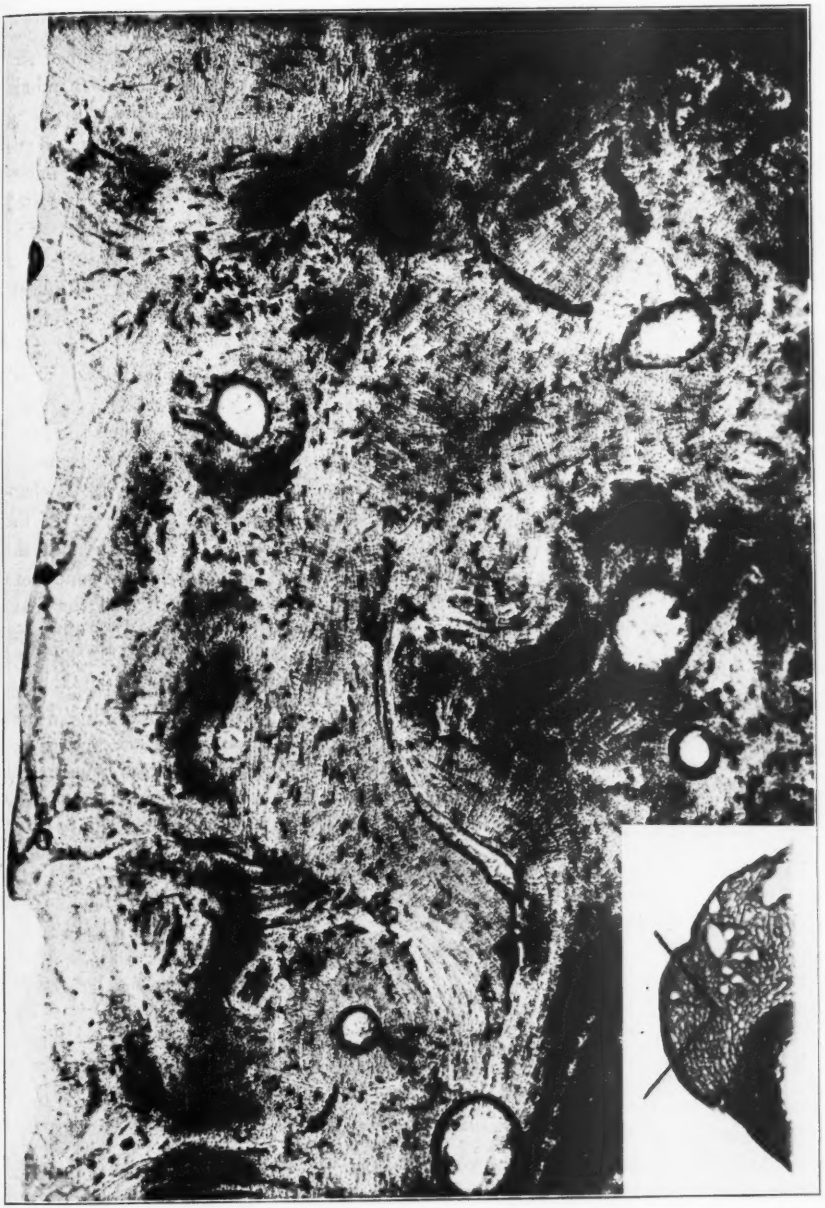

Fig. 3.—A section from the periphery of the repaired zone, showing haversian systems of irregular outline and atypical appearance similar to that found in sections of the bone filling in the alveolus of an extracted tooth.

to the first molar. Within the alveolus, successive radiograms made over a period of months reveal osteoid tissue growing from the sides toward the center. The lamina dura gradually loses its identity, and the amorphous bone occupying the upper part of the alveolus takes on the appearance of normal cancellous tissue, the larger trabeculae of which are parallel to the alveolar border. It should be kept in mind that the type of stress present in the rebuilding alveolus is entirely different from that which was present when the tooth was *in situ*. Extraction of the molar removes the leverage action of the roots through which lateral and compressive forces of mastication were conveyed to the surrounding bone. In response to the changed functional requirements and in accordance with the law of bending stress produced by the forces exerted in the anterior region of the mandible, the bone eventually formed over the opening of the alveolus is of the compact type, while the bone which formerly occupied the area between the mesial and distal roots becomes wide-meshed in character or may be completely absorbed. Examination of a coronal section through the site of the former alveolus after complete reorganization of the alveolar process shows the superior border to be almost indistinguishable in width and density from the lower border of the body of the mandible.

The irregularity in number and location of the haversian systems and the asymmetric arrangement of the concentric lamellae noted in the histologic examination of the bone formed in the alveolus lead to an inquiry concerning the histologic characteristics of bone formed under similar circumstances elsewhere. The femur and mandible are under somewhat similar bending stresses and have many interesting similarities in structure. A femur exhibiting a healed overriding fracture located midway in the shaft was secured. The two fragments had been united by a lateral outgrowth of bone, the continuity of the nutrient canal being lost. Cross-sections in the fractured area showed an interesting arrangement of bone. The periphery of the new bone filling in the interval between the fragments was composed of a layer of compact bone similar in structural characteristics to the superior border of the healed alveolus. The transition of the new bone to the open-meshed cancellous network toward the center of the shaft had the same characteristics of the bone occupying the lower portion of the former alveolus. In conformance with Wolff's dictum, the contiguous portions of the overriding fragments which occupied the center of the fracture and were now located in the neutral zone had undergone absorption and had the appearance of cancellous bone with wide open spaces, instead of its former haversian type of bone.

Clinically, this mathematical arrangement of the bone repairing the fracture of the femur and that of the bone filling in the alveolus of the mandibular second molar has a direct application to the interpretation of those localized areas of lessened density frequently diagnosed as areas of "residual infection." It has been shown that the bone in the periapical region of the alveolus undergoing repair was absorbed when this area, on account of the changed structural requirements, was

converted into a neutral zone. From the standpoint of bone mechanics, these so-called "residual areas" are more often evidences of normal bone repair, and contain no more infection than the shaft of a healthy femur.

CONCLUSION

This paper is an attempt to show the identity in structure and function between the alveolar process and the remaining skeleton. Normal structures and functional changes have been emphasized to the exclusion of pathologic findings. An attempt has been made to emphasize disuse atrophy and to offer a means of diagnosis for that great predisposing cause of dental disorders. The recognition of the underlying laws of bone mechanics will clarify some of the apparent contradictions in prosthesis, periodontia, dental oral surgery and radiographic diagnosis.

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PROPER FORM OF FILLINGS*

By WILLIAM FINN, D.D.S., Pittsburgh, Pennsylvania

I THINK all will agree that the proper form of a filling is one which reproduces the original anatomy of the tooth before decay took place; unless it be in case of irregularity, when it might be well to change the contour to meet the requirements.

Drs. Black, Johnson, Wedelstaedt and others have written so beautifully, and in such plain language, that I shall quote them often.

"Every filling should be finished as smoothly as the polished surface of the tooth." This finish should be so made that a sharp explorer point when used lightly will glide smoothly without hitch or catch from the enamel to the filling. There should be no overlap of the filling onto the enamel at any point. This accuracy of the finish is as necessary as any part of the adaptation of the filling to the walls of the cavity.

An accurate knowledge of dental anatomy and ability to so make the outline form of the cavity that a filling can be made to conform to the original contour is necessary from the standpoint of esthetic sense and general usefulness of the filling in mastication, and for protection against the recurrence of decay.

In olden days, before the discovery of cohesive gold, it was the habit and a necessity to make the proximal surface of fillings flat, without the proper contour and contact point, and I am afraid the habit is much indulged in at the present time. After the discovery of the cohesive property of gold, almost immediately an endeavor to build fillings to restore the original contour of the tooth was evident, but the lack of knowledge and study of tooth form made this progress slow.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

To have sufficient space to make our proximal fillings, the separator must be adjusted, unless for some reason space is already present, so that an extra amount of gold may be placed at the contact point against the proximating tooth. The first trimming is done with Black's adjustable saw frame, with the Keber saw ground very narrow, almost like a hair.

The saw is taken from the frame and placed through the interproximal space under the filling at the gingival border with the teeth of the saw toward the occlusal. The saw is adjusted to the frame, the operator first cutting the gold from the gingival to the contact point, stopping just before reaching it. Next, he slices to the buccal embrasure, then to the lingual embrasure. If the gold has been cut sufficiently close to the enamel margin, we have no further use for the saw.

FINISHING KNIVES

The next step is to search the gingival portion of the filling for overlaps with finishing knives. With these knives, all remaining overlaps are removed and such further trimming is done as will fit the gingival portion of the filling for the final finishing. These knives should be very sharp, and with a light sliding cut, thin shavings will be removed in rapid succession.

FINISHING FILES

After the gingival surface has been satisfactorily taken care of, our attention should be given to the buccal and lingual surfaces. For this trimming, the fine-cut finishing files are most useful. With these, any part of the proximal filling can be reached, trimmed and shaped to the form desired.

The Black set of files are made with a flat cutting face with rounded backs, also a rounded cutting face and a flat back at varied angles. The flat cutting face is used for the lingual and buccal margins, while the rounded cutting face is used in making the concaved form beneath the contact point.

Dr. Wedelstaedt has designed several files for this purpose, which are very useful owing to their finer cutting surface, some with the "push cut" as well as the "pull." The ones I like best are similar to the Black set, only a finer file and bent shank. There are several smaller files which have small oval faces similar to the ones used by the late D. D. Smith in his prophylactic work. These are extremely useful where the gingival approaches the bifurcation of the root.

In the bicuspids and molars, it is desirable to have the surface concave just beneath the contact, coming to a flat surface near the gingival. As a rule, the contact point is left untouched until the last, as we wish to save all the interproximal space that we can. Proximal decay and proximal wear has robbed us of about one-third inch in each arch at the age of 40, so if, by placing a separator, we gain space to make a more prominent and tight contact point against the proximating tooth to take up part of this lost space, we have done a great service.

PROXIMAL SURFACE

Shaping of the proximal surface to a suitable rounded contact point is one of the most important things to be attained. The usefulness of the filling depends directly on the form given.

Many failures of fillings are caused by imperfect work on this surface. A suitable formed contact point with a well shaped surfaces does not allow the food to collect between the teeth, but does allow the free excursion of food through the embrasure. In chewing, this keeps the margins well cleaned and the danger of recurrence of decay is limited. One of the conditions which cause failures arises where the broad flat surface of the molar does not allow the food to pass through the embrasure.

If fillings were made wider buccolingually, and the embrasure wider, with a depression running over the marginal ridge, food would enter the embrasure, thus stimulating the gum tissue and preventing recurrence of decay.

The contact point should resemble the contact of two marbles. The rounding may be continued for a space toward the gingival, then the curve should be reflected to form a concavity followed by a straight line toward the gingival. This prevents the lodgment of stringy food particles that are forced past the contact point, and will loosen the moment the contact point is passed and will be pulled away in the next excursion of food past the embrasure. The rounding from the occlusal surface to the point of contact helps to convey the food on its proper journey. With such forms, the interproximal gum tissue will continue to fill the space almost completely, to a good old age.

The occlusal surface must be completely restored in the making of fillings; all the cusps, marginal ridges, triangular ridges, oblique ridges, grooves and pits that go to make up the anatomy of the lost surfaces of the tooth.

In gold inlays, they should be carved in the wax before casting is done.

In amalgam, the carving is done while the amalgam is in a plastic state.

As the ridges, cusps, grooves and pits are very necessary in tearing and grinding food, it behooves us to study the anatomy of the teeth. One will find it a great help to have extracted teeth, or models of well formed teeth, to freshen the memory regarding tooth anatomy.

The occlusal surface of fillings are trimmed best with rotary instruments, either stones or finishing burs. Stones will do the work with less pressure, but will also cut the enamel as fast as the filling unless great care is taken. Polishing should be well done on all parts with disks, wooden points, leather points and polishing strips. Rotary disks should be used in polishing the buccal, lingual and occlusal surfaces as far as possible into the embrasure without endangering the contact point. In no case should the disk or strip be allowed to pass between the contact point and the proximating tooth, as it will surely flatten the contact point.

The gingival portion may be polished with narrow polishing strips without going past the contact point. After all the filling has been roughly polished, the near contact point may be highly polished with a thin flexible tape with fine grit, and the contact point may be polished with fine cuttle fish strip after the separator has lifted the teeth slightly apart.

The same process may be followed with amalgam fillings as with gold fillings, only at a later appointment. With the gold inlay, a different method is used: The proximal and occlusal surfaces are ground and polished to form with a suitable contact point, and sol-

dered on, and all the surfaces are highly polished before setting, with the exception of the margins, which have their final finishing at a later time.

DISCUSSION

John Scholten, Cedar Rapids, Iowa: During the past three years it has been an inspiration for me to see some of Dr. Finn's work—fillings that have stood the test, and were not found wanting. It is always a pleasure and an advantage, when any of the processes which we are called on to perform day after day are brought to us in concrete, systematic and usable form. Too much emphasis cannot be placed on the necessity of finishing a filling as "smoothly as the polished surface of the tooth." Unfortunately, there seems to be a tendency among some operators to neglect this cardinal point. Dr. Finn has pointed out that accurate finishing is as necessary as perfect adaptation to the walls of the cavity, and I concur with him. I cannot see the logic in expending the time and energy necessary to prepare a perfect cavity, and so adapt a filling, and I care not whether it is foil, amalgam or the gold inlay, subsequently neglecting to finish it properly—thus providing a possibility for its early loss by the recurrence of decay, or perhaps the early loss of the tooth. It is indeed regrettable that fillings without contour and contact points are still considered "good dentistry," this in spite of the generally accepted teachings of Black, Johnson and others of our own time who have been tireless in their efforts in teaching tooth form and proper filling form. That this condition exists cannot be denied, as an examination of the mouths of most patients will reveal a rather amazing lack of knowledge of proper tooth form and proper filling form. Failure in the proper placing and shaping of the contact point and of the proximal surface gingival to it constitute, I believe, as great a menace as the gingival overhang. Both are deplorable conditions. Well-defined contact between the contact point of a filling and approximating natural tooth, or between two approximating fillings, with slightly more interproximal space than is normally present in early adult life, and the opening up of the embrasures will permit the septal tissues to assume a more blunt form, which is more easily maintained in a healthy condition than the narrower and sharper forms always present when the interdental space has not been properly reproduced. I do not believe in making an excessive plus contact. It is true there is proximal wear, but there are no lost contacts in normal occlusion, regardless of wear. In the twenty-five or thirty years that it has taken Nature to rob us of this one third inch, how are we going to help restore this loss with one or more filling operations? Might not more harm be done by the change in occlusion?

Finish of the occlusal surface should mean its complete restoration to functional and as nearly anatomic form as condition will permit. I believe that I understand Dr. Finn in that he does not mean the developmental defects should be reproduced, but rather the angular depressions, which result from shaping the internal triangular ridges and slopes of the sulci, acting like the ridges on a mill stone. As a rule, this is not so difficult as the finish and shaping of the proximal surface. However, the fact that it is easy of access is no good reason for us to slight it. In addition to the instruments suggested by Dr. Finn for the finishing of this surface, I find the small round burs, sizes ½, 1 and 2, dulled by previous use, very efficient. They do not injure the enamel and, if anything, tend to give these places a higher polish.

Harry A. True, Des Moines, Iowa: This discussion consists of one commendation, one slight criticism and one suggestion. Dr. Finn has presented an ideal, namely: "The proper form of a filling is one which reproduces the original anatomy of the tooth before decay took place." Teeth are such wonderful works of art and of mechanics that we should do our utmost, when cavities occur, to restore the teeth with the forms with which Nature has so beautifully endowed them; for if we deliberately take away the marginal ridges and parts of the occlusal surfaces of the beautiful and useful bicuspids and molars for our own convenience in making restorations in the proximal cavities of these teeth, we owe it to these teeth, to our patients and to Nature to replace those surfaces with just as good replacements as is possible. Dr. Finn said, "One will find it a great help to have plaster models of well formed teeth to freshen the memory regarding tooth anatomy. This is important. A plaster cast records and reproduces with exactness the individualities of the

tooth's surfaces that are to be restored and greatly aids the operator in finishing the filling to form. A sculptor or portrait painter would not think of trying to reproduce an object by use of the eye and chisel or brush without having his model before him. So we as tooth sculptors should have before us a plaster cast of the tooth that we wish to restore. To secure a good impression of a tooth which has not, as yet, the marginal ridge broken through, a fairly good modeling compound impression should be taken in the crown tray, chilled, removed, and the inside softened by running very hot water into it, and the impression replaced on the teeth, with a firm pressure. This will give an accurate reproduction of the occlusal surfaces and nearly all the contours of the crowns of the teeth. The plaster cast made from this impression is kept very near the field of operation, whether it be a gold foil, a gold inlay or an amalgam restoration. A good practice in study is to take another impression of the completed operation and make a plaster cast to compare with the one taken before the operation was started, to see how nearly perfect the restoration has been made. A dentist who compels himself to make the minute study of the details that is necessary to a complete restoration of the human teeth is he who has a real vision of professional responsibility. Now the criticism: There were at least three points in Dr. Finn's paper at which he referred to the "concavity just below the contact point." This may be a little misleading, for no matter how apparent this concavity seems, in my study of tooth form I have failed to find any bicuspids or molars which have a concavity on the proximal surfaces; rather, all have convexity from the contact point to the margin of the enamel at the gingival line. The suggestion is this: To me, the term "filling" suggests a hole filled level full of a substance or material. Would it not be better for us to refer to these classes of dental service as gold foil, gold inlay and amalgam restorations? This term suggests the complete restoration, including the contours of the teeth which we have restored.

A SIMPLE, SOMEWHAT CONDENSED, PRACTICAL AND ACCURATE TECHNIC FOR PARTIAL DENTURE CONSTRUCTION*

By KENT KANE CROSS, D.D.S., Denver, Colorado

OF all the difficulties confronted in the various branches of dental service, it is generally conceded that partial dentures present not only the most intricate difficulties, but also the most varied. Orthodontia, periodontia, operative dentistry, exodontia, and radiodontia have only to be studied to disclose their difficulties and limitations, and I shall attempt to compare only the problems of the other restorative branches of dentistry with those of partial dentures.

The smallest restorations, those of single teeth, involve mainly a proper cavity preparation, a satisfactory restorative material, proper insertion, the contact and occlusion of the two or three teeth involved, and smooth margins. Replacing one or more teeth with a fixed bridge involves the condition of the teeth to be used as abutments, the length of span of the bridge, the construction of the pontics, sanitary precautions, care in assembling and placing the bridge, and, of course, the polishing of all surfaces and margins. Removable bridges, considered as restorations that are supported by abutting teeth rather than by the soft tissues, have some special problems, but, in the main, present problems similar to those of fixed bridges. Full dentures are the largest restorations, with more physical loss and replacement of tissue, including the teeth, and would seem to be the most difficult branch of dentistry, but there are no irregular, loose, or weak natural teeth in the way, and, in addition to the physical aspects, most people have some pride to supplement the perseverence that is necessary for their retention and function in the mouth. In all branches of our profession, dental esthetics, or dental art, should go hand-in-hand with the mechanics and science of dentistry. We should never forget that our duty to a civilized people is to strengthen personality by adding to, when possible, rather than detracting from, the appearance of those who entrust themselves to our professional care.

It is with some temerity that I presume to present a technic or method of procedure, for constructing partial dentures, when Beach, Roach, Furrows, Orton and the Montreal group headed by Cummer, as well as other authorities of this and other generations, have either failed to agree or have changed their own opinions and technic.

While a partial denture may replace from one to thirteen teeth, we believe that, with few exceptions, there is little call for either extreme; when there are

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

only one or two teeth missing, and replacement is indicated, some sort of a bridge can be devised which will serve better than a partial denture. Likewise, when all but one or two teeth on a maxilla or mandible have been lost, a full denture is usually to be preferred, and because of the almost innumerable combinations of cases that may be included under the head of partial dentures, we shall attempt to present only a few; nor will we attempt arbitrarily to dictate any particular attachment to be used, believing that a denture gets support from the underlying soft tissues, and, in many instances, needs only a light resilient wire clasp about the approximating natural teeth, or no clasp or attachment at all. However, if some form of clasp with an attachment that allows freedom of movement without stress on the teeth, such as the Dresch, and prevents possibility of dislodgement of the denture, can be utilized, then we would say, use such a clasp and attachment.

Let us consider a case in which only the six anterior mandibular teeth are present. After taking into consideration the mental attitude, age, sex and physical condition of the patient, a study of the case and the conclusion that the remaining teeth will give service, instead of being a detriment to the proposed restoration, we make an impression of the tissues involved, using whatever method seems most practical for obtaining a fairly accurate impression. The use of modeling compound on a metal tray, the edges of which are free, may give the desired result. If a plaster-of-Paris wash, or one of the impression waxes, such as the Renfrow wax, is used for a better result, it may be placed over Hall's black compound, care being taken to trim around the teeth before applying the wash or wax. In any event, the case is to be rebased if necessary, and after settling under compression, rebasing usually is necessary.

The impression is next poured in artificial stone or plaster-of-Paris. If the latter is used, it should be vulcanized on within forty-eight hours. When the cast has hardened sufficiently, the impression is removed, the case is dried, and a base denture rubber is placed on it, without the delay waxing would cause. This method is similar to that used in the Wadsworth method of full denture construction, in which pink denture rubber is used, and is adapted securely to the cast by means of Goodyear rubber tire cement. I first saw this method of packing, or adapting, base rubber on a cast used for a partial denture, and the securing of the clasp in the vulcanizable rubber and around the clasped tooth, by J. L. McDonald of Denver. Any base rubber will do, but it should have a smooth surface and gold base rubber is very satisfactory in this respect. A cast clasp with a stress-breaking attachment is found very satisfactory, but is unnecessary in a large percentage of cases and, as simplicity and inexpensiveness are considered, resilient No. 20 gage round clasp wire may be adapted to the surface of the plaster cuspid tooth, as a single finger, extended labially to the interproximal space below the contact point so as to assure a little retention, only a little being necessary to prevent the unseating of the denture. If desired and the space justifies it, the clasp may be made in loop form. The retention of the clasp is effected by the tang being pressed into the rubber, distal

to the clasped cuspid, where it has just been adapted to the cast by means of the rubber cement. A small piece of the rubber should be placed over the tang of the clasp to assure security. Incidentally, the vulcanite should be stretched slightly in adapting it on the ridge to prevent bulk and trouble when assembling the teeth, especially in short bite cases. The pieces of vulcanizable rubber between which the tang is sandwiched may be sealed together by a hot spatula, or by chloroform.

The same procedure is followed on both right and left sides. Vulcanizable rubber may be extended from one side to the other as a lingual bar, but a cast or stock metal lingual bar is to be preferred. The stock lingual bar, if used, should be carefully wrought to place, this being easily done with combination bending pliers. The ends of the bar should be securely placed in the rubber base and held by small, thin additional pieces over them. If difficulty is had in holding the bar in position, a little plaster-of-Paris on the anterior, or middle third of the bar, will hold the parts firmly together. A narrow strip of vulcanizable rubber should follow the periphery of the base, to serve as a strengthener and as a flange for the base when the case is being completed.

The case, with the vulcanite base, lingual bar and clasps in position is flasked without delay or danger of getting the parts out of position during separation, packing and closing the flask.

After vulcanization, the base is placed in the mouth and any fitting necessary is done to make the base comfortable. If occlusion appears normal where the natural teeth oppose, the case is articulated in any simple manner.

We believe that irritation from denture bases and the absorption of the alveolar process and ridge are due largely to traumatic occlusion, and to be scientifically correct, a survey of the present occlusion is necessary, and also the possibilities when the full complement of teeth is restored. Observations of facial lines and measurements are made. Measuring from a point about a half inch forward of the top of the external auditory meatus, in the fold of skin, a line is established directly forward to the outer canthus of the eye. From the first point just in front of the ear, another line is drawn to a point just below the ala of the nose. A point half way between these lines is established, and a third line drawn from the point anterior to the ear through the point just established on the cheek. These can be drawn and erased easily if a soft drawing pencil is used. The line just drawn should, in a normal profile, be at about a right angle to the perpendicular line from the glabella to the lowest anterior extremity of the chin (symphysis menti). The occlusion or bite rim is built on the vulcanized base, the bite fork, for the face bow is placed in the rim. The face bow cushions are placed on the marks anterior to the ear, which are external to the rotating center of the condyle heads. It is fastened to the bite fork, the Wadsworth T is placed parallel to the line drawn between the outer canthus of the eye and the base of the ala of the nose, and the cross-bar of the T is secured to the face bow by an additional lug. In the normal or orthognathous type, the cross-bar of the T should be parallel with a line from the glabella to the symphysis menti.

A compound impression is made of

the lower anterior teeth and the incisal tips of the upper anteriors with the base and occlusion rim in position. When the case is mounted on the articulator, this is poured in plaster of Paris. A cast of the upper teeth is mounted, and articulated to the lower occlusion rim. Lateral check bites are taken with modeling compound.

From a point between the mesio-incisal angles of the upper central incisors, or in case they are not in normal relation, the point between where these angles should be, the point of a divider is extended to a point on the horizontal shaft of the articulator, external to the condylar adjusting units representing the rotating center of the condyles on either side, with the distance established. One point of the dividers is retained at the point representing the condyle center and the other scribes an arc across the centering plate above the machine. From the point between the angles of the central incisors as a centering point, another arc is scribed. The intersection of these two arcs is taken as a point from which to scribe the prosthetic curve, which is the curve to which the occlusal surfaces of the teeth should be placed. If there is a denture to be made above, this can easily be done. If natural maxillary teeth are present in almost normal occlusion, the case is simple. If the teeth are elongated, grinding to the occlusal curve is indicated, or if that is impractical, extraction with replacement by a bridge or partial denture may be indicated. Good prosthetic dentistry is not possible with traumatic occlusion.

The technic is similar for an upper or maxillary partial denture, replacing the posterior teeth, but a flat, hard basal area is not a favorable case. Many of these patients, especially when the anterior teeth are in poor condition, should have a full denture. When the partial denture is used, some persevering patients may learn to use the restoration with comfort, but a clasp with a stress-breaker attachment similar to the Dresch No. 2, will be much more satisfactory. This can be placed in the proper position and, with the rubber, adapted to the cast as just described in the lower or mandibular case.

In the opening paragraph of this paper, the difficulties of this class of denture service were admitted, and we believe the technic described will be no panacea, but will add to both the simplicity and science of partial dentures and will eliminate loss of time and the disarranging of assembled parts. Briefly, we believe partial denture service presents more difficulties than other dental specialties. We appreciate the deep water we are treading when we have only partially learned to swim. Of the innumerable cases that may be classed under this head, we attempt to describe only two. A light finger or loop clasp is sufficient in the simpler cases, but where a more rigid type is necessary, the stress-breaking type is safest. Traumatic occlusion is the cause of much soreness and absorption of the tissues and a survey of the occlusion present is urgent. Interfering cusps, or even the teeth should be eliminated. In fine, familiarity with the case, a technic as simple as the facts will bear, but constructed on scientific principles, and cooperation with the patient and by the patient are the strong points in favor of successful partial denture service.

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RADIOGRAPHY AS AN EFFICIENCY AND ECONOMIC FACTOR IN OPERATIVE DENTISTRY*

By CLARENCE O. SIMPSON, M.D., D.D.S., F.A.C.D., St. Louis, Missouri

IN describing the applications of radiography in the sphere of operative dentistry, there is an unavoidable repetition of procedures which have previously been advocated. An attempt will be made to present the plea in different words and by another argument, and there are eminent precedents for reviewing operative requirements. If the program of this section was contingent on the contributors offering original theories or new processes, the dearth of material would necessitate the abandonment of the project. The standardization of dental repair is so well established that no radical innovation of marked advance has been introduced since the casting process. Why, then, is there a function for this section, and what is to be accomplished by reiterating the details of reparative operations? It is because such a gross discrepancy exists between the textbook standard of operative procedure and the general character of the operations which are performed that a repetition of the technical requirements are indicated in order to improve average practice.

Through inadequate conception of the basic principles involved, disregard for the professional obligation assumed or deficiency in the requisite skill, the majority of dental repairs are a physical menace rather than restorers of function. If the technical requirements demanded extraordinary qualifications, the apparent incompetency would be excusable. Instead, the functional restoration of teeth requires only cavity form to prevent displacement, adaptation of the restorative material to the cavity margins and reproduction of the normal tooth form. It is in the latter feature of contouring the restoration to anatomic form that the lack of proficiency is most evident.

There are literally hundreds of arts and crafts with more exacting demands for reproductive ability, and the failure of dentists to restore anatomically portions of teeth, after years of practice with models before them, is a disgrace to the profession. There is always resentment against dentistry being classed as a mechanical vocation, yet most dental reconstruction would not pass inspection in any factory, and most dentists could not qualify as expert mechanics. If industrial craftsmen were no more proficient in their respective fields than are dentists, the world would be in chaos. Compare the crudity of dental repairs with the precise mechanism of a locomotive, a

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

watch, or a microscope. Compare the dexterity of a glass blower, a sign painter or a juggler with the incoordination of some dentists. Imagine the impediment and discomfort of walking, if shoes fit no better than crowns. The contention might be raised that automatic machinery is employed for most industrial construction, but human hands make and operate the machinery, and assemble the products. The excuse might be offered that dental operations are performed under unfavorable conditions, but industrial construction is accomplished in extreme temperatures, a thousand feet in the air, and under water.

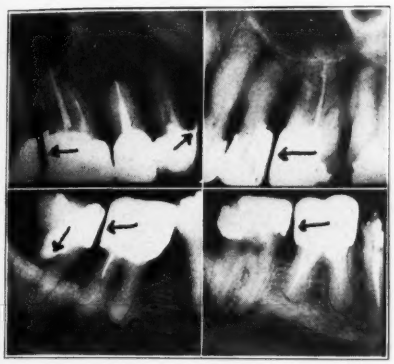


Fig. 1.—A lack of contact between restorations permitting the wedging of food in the interproximal space. (These and the following illustrations, except the last two, were found in a random search of one hour in the author's files.)

The complaint is sometimes heard that there is too much competition in dentistry. There is not enough true competition to develop efficiency. Suppose dentists were to compete before competent judges and the public for speed, skill, number of strokes and fielding averages. What would be the range of handicaps, and how many would be disqualified for a breach of the rules? Suppose dentists were grouped for the production of "piece work" under inspectors responsible for the maintenance of standard specifications. Conjecture the report of an efficiency engineer on dental practice with its lost motion of always searching for a different instrument, and the lost time

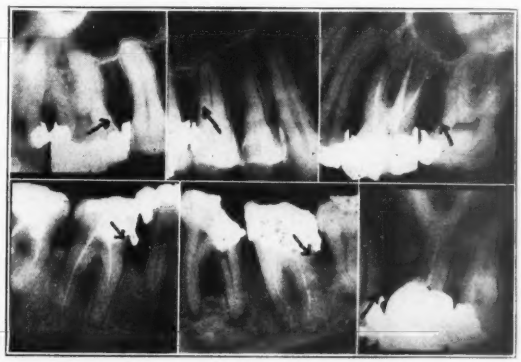


Fig. 2.—Excess filling material projecting at the gingival margin, with a corresponding destruction of the septal tissues.

trying to decide what to do next. Such is the evolution of a one-man vocation when the employer is technically unqualified and often physically incapacitated to judge the craftsmanship.

asset in dentistry, but as long as restorations and replacements are required, dentists must have natural and properly trained constructive ability.

A dentist with a military complex

Fig. 3.—Left: A continuous amalgam filling from one tooth to the other, filling a cavity in each tooth and connecting the teeth. Center and right: Failure in restoring anatomic form, and inaccessible contact surfaces.

Neither Christmas-tree operating units, nor duplex operating rooms with time clocks have increased the efficiency of dentists. Neither will the critical survey of dental schools, and a revamping of the curriculums with medical subjects improve the operative skill of the graduates. If a survey was made of the predental classes, there might be more opportunity to effect a reform. Then the candidates lacking in dexterity and mechanical ingenuity might be shunted

has compared dentistry to the departments of an army. The comparison may be made more specific and to emphasize the deserved importance of operative dentistry. Orthodontists correspond to the diplomatic envoys who strive to adjust the early inharmonious relations, but their influence is weakened by diverse propaganda. Operative dentistry composes the offensive and defensive army, to which the other departments are merely accessory. In it

Fig. 4.—Left: A restoration with exaggerated contour and an occlusal rest. Center: Inharmonious relation of two restorations which probably were believed to be anatomically contoured. Right: An extreme gingival projection which may have been a factor in the loss of the adjacent tooth.

into medicine, where they could gravely pose and do less harm than in dentistry. Scientific knowledge is an important

are a few heavy artillery pieces capable of efficient execution, but in the larger infantry group the majority

are undrilled, poor marksmen, overequipped and insubordinate. Some ride horses with names such as odontotomy, ceramics, foil, plastics and pulpotomy. There is a chemical division whose chief offense is in the employment of proprietary concoctions. Radiodontia is the observation department, dropping a few bombs, but principally engaged in obtaining information, most of which is ignored. Periodontia and exodontia are the ambulance corps, which are over-

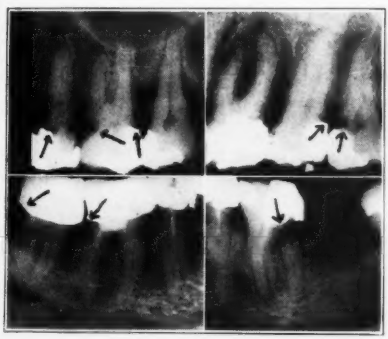


Fig. 5.—Defects at the gingival margin of restorations, and recurrent gingival caries.

worked because of the inefficiency and tactical blunders of the operative division. Prosthodontia is the reconstructive unit, which endeavors to reestablish communication and restore service after the destruction due to the inadequate defense of the operative division.

The operative branch is the chief defense in the vaunted superiority of modern dentistry. Since caries is not generally preventable, promptness and serviceability of dental repair are the decisive factors in dental maintenance. When repair is delayed until the pulp is endangered and the integrity of the tooth is impaired, or when the repair fails to protect the tooth and restore function, the ultimate service of the tooth is definitely reduced. In the treatment of pulp complications, operative dentistry has made its most ignominious and complete failure. The instances in which the sequelae have not been disastrous are usually due to the defensive and reparative power of vital tissues rather than the perfection of the operations. Only slightly less consistent, and of serious consequence, are the discrepancies in reproducing the marginal ridge, with subsequent gingival and alveolar destruction. With the prevalence of periapical infection and septal destruction following dental repairs, the record of operative dentistry is far from commendable. Saving teeth from caries at the cost of periapical or periodontal disease, and the betrayal of patients by false security, are not compatible with professional ethics or personal honor. As long as average dental operations produce rather than prevent disease, there will be need for vigorous criticism to arouse a sense of responsibility; for reviews of technical requirements to guide the incompetent, and for a more extensive means of examination and inspection. In the latter requirement lies the utility of radiography in operative dentistry. Radiography will not develop an artistic conception in a laggard's brain, or a master's touch in bungling fingers, but it does supply information which cannot otherwise be obtained and vividly portrays many of the errors of reparative operations.

Since pulp canal operations have, in large proportion, been failures, and the requirements are extremely rigid, the involvment of pulps should and can be prevented. Since carious teeth are not generally restored to anatomic form,

the portion to be restored should be limited as much as possible. To avoid pulp involvment and limit the extent of repair, carious destruction must be discovered soon after the dentin is invaded. Caries in the exposed surfaces of teeth is readily discovered by instrumental examination, but, in the approximal surfaces, it is usually not evident until serious damage has occurred. An instrumental examination of the approximal surfaces is difficult, and, if thoroughly done, generally requires mechanical separation, with probable discomfort and injury. Radiographic examinations disclose approximal caries with facility and accuracy, even in the incipient stages. Why separate teeth for periodic examinations, or wait for advanced carious destruction? In cavity preparation, the pulp is endangered either by leaving carious dentin, or excavating too near the pulp. The form and relative size of pulps are not uniform, and radiography offers the only method of revealing the pulp outlines without injurious exposure. The horns of pulps may project much farther than would be expected, making even slightly radical cavity preparation hazardous. Pulp recession may permit of extreme excavation without sensation or harm. To avoid disastrous complications, information regarding the relation of the pulp is essential in cavity preparation, and radiographic examinations should be used for this purpose.

When the approximal surface of a restoration is not properly contoured, the gingiva is subjected to abuse by the impact of fibrous food, or the retention of food débris. This tends to interfere with mastication, through disuse; causes destruction of the septal tissues by trauma and disease, and predisposes the adjacent tooth to decay. The reproduction of the contact point and the normal contour should be instinctive to an operator with proper training, yet it is not consistently accomplished. Radiograms which present a profile view of the approximal surface and its relation to the adjacent tooth offer opportunity for the correction of errors before

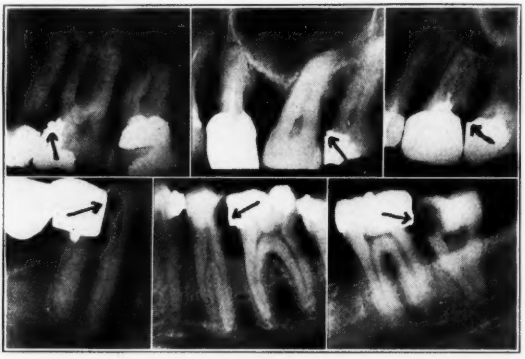


Fig. 6.—Imperfectly contoured restorations, with corresponding caries in the adjacent teeth.

harm results. The gingival margin of approximal restorations is the most difficult feature to perfect. Amalgam fillings are usually adapted to the gingival margin, but often an excess of filling material is left projecting beyond the margin. Discrepancies in approximal cast inlays are more likely to occur at the gingival than at other margins, because the difficulty in securing an accurate pattern in this location, distortion, shrinkage and faulty castings interfere with adaptation at the gingival margin. From deficient root preparation or improper construction, to the injurious possibilities of negligence.

Efficiency in the meaning of placing restorations which give the maximum service, and taking advantage of every facility to reduce the operating time, labor and risk of failure, is a practical economic factor in dentistry. Production has a direct influence on the financial compensation of the dentist. He can increase his income by extending his productive hours, advancing his fees or increasing the production per hour. The production hours are limited by the endurance of the operator, and

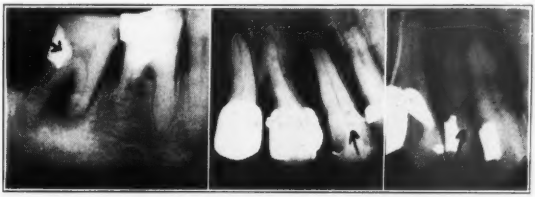


Fig. 7.—Periapical involvement from septic pulps, probably produced by fillings placed too near the pulp.

shell crowns rarely approximate a fit at the gingival margin. The buccal and lingual margins may readily be explored, but, on the approximal surfaces, where the root preparation is most likely to be deficient, there is little access for examination. Radiography is not a substitute for skill, but it will reveal these obscure defects. If approximal amalgam fillings are radiographed after presumably being finished, and inlays and crowns are subjected to radiographic examinations before cementation, there is opportunity for correction and a stimulus for technical improvement. The time entailed and the cost of radiographic examinations are insignificant in comparison should not be extended to the point of fatigue. Fees are restricted by equity, and the consent or ability of patients to pay. Increasing the production per hour by systematic methods, accurate diagnoses, operative facilities and elimination of errors is advantageous to both the operator and the patient. Unless fees are unfairly computed on a strict time basis, reducing the time required for an operation renders it more remunerative for the dentist. A reduction in the number and length of appointments is attractive to the patient in economy of time and physical stress. In theory and application, more remunerative fees are obtained for simple than for complicated dental repairs.

Fees are relatively higher for operations requiring one hour or less than for those entailing several hours. It is difficult for patients to appreciate the justice of an adequate fee for the repair of a tooth which requires five or six hours' operating time, while if this amount of time was employed in the repair of five or six teeth, the fee would not be questioned. This impression influences the dentist to make fee concessions in the complex operations; which unfairly reduces his compensation.

Radiography promotes systematic methods, is indispensable in diagnosis,

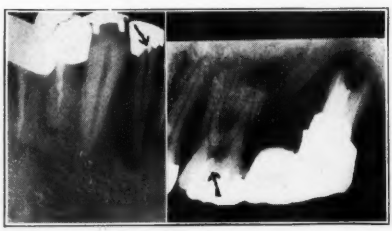


Fig. 8.—Cement forced into the pulp during the cementation of inlays, where the cavity preparation was too deep.

facilitates operations and gives information toward eliminating a large proportion of errors. Periodic radiographic examinations enable the dentist to observe conditions in obscure locations and avoid the necessity for extensive repairs. The greatest time consuming factor in operative dentistry is pulp complications. When caries is neglected until the pulp is endangered, the sensitiveness interferes with excavation and retards operative progress. Treatments may be necessary to allay pulpitis or to obtund the dentin. The extirpation of the pulp, with tedious canal operations, may be required, or, if an attempt is made to retain the pulp, it may subsequently become diseased, with exasperating results. Caries in the exposed surfaces of teeth usually produces a warning hyper-sensitiveness when the dento-enamel juncture is reached. Caries in the approximal surfaces are not generally observed or discovered by instrumental examination, and do not cause pain until extensive destruction has occurred. Radiographic examinations reveal incipient caries in the approximal surfaces, permitting of repair before serious damage has resulted. Periodic radiographic examinations are an important factor in the economy of time in operative dentistry, since a few minutes devoted to the examination may save hours of difficult operating.

Development of efficiency and economic factors of operative dentistry lies in prophylactic service to reduce the prevalence of caries, and in thorough periodic inspections, including radiographic examinations, to minimize the reparative operations. To promote the efficiency of restorations and to avoid the economic loss of replacements due to operative errors or pulp disturbance, radiography should be utilized in operations approaching the pulp and for the inspection of restorations after construction. This application of radiography does not replace the mechanical or surgical requirements, but is an aid and a disciplinary influence in conforming to the fundamental principles of operative dentistry.

DISCUSSION

Edgar D. Coolidge, Chicago, Ill.: The importance of radiography is such to the general practitioner that it should be a matter of regular routine to demand of the patient a complete radiographic examination and diagnosis before the regular mouth examination. Not only at the first visit of a new patient is this advisable, but also, once each

year, this type of examination should be made for the assistance it is in a successful campaign for the prevention of caries, pulp complications and gingival irritation. Dr. Simpson has compared the department of radiography to the observation department of the Army and no one in this day can question the value and necessity of that field of service in the offensive and defensive problems of the military. The first requirement of good service in our profession is thorough examination and recognition of all defects and pathologic conditions. The second important requirement is the proper interpretation of the findings and recognition of the damage that is being caused by such conditions, sometimes immediate and other times subtle and prolonged. There is a constant and ever-present tendency to underestimate the future ill-effects of neglected or unnoticed mechanical defects in operating, and these are generally found in imperfect fillings at the gingival and in poorly filled crowns. The evidence presented in the lantern slides illustrates those points. These are not things that develop in a day. These fillings were probably in place for years. The important thing is to recognize these things early and to interpret results before it is too late, when, as in most of those cases shown, the teeth are ready for the forceps. The radiographer is the one who has this weakness in operative procedure constantly called to his attention, and it is not strange nor inappropriate that this paper is very drastic in pointing out such defects. Let us not forget that when the radiographer sends an indistinct film or one in which the focus is not perfect, the operator must send the patient back for another picture. Would it not be fair play, and certainly to the best interest of the patient, if the radiographer would refer the patient back to the operator to correct the mechanical defects as well? The statement pointing out the usefulness of the radiogram is complete and needs little comment. I wish to emphasize the points relating to pulp complications, such as the detection of small interproximal cavities. Frequently, there is great destruction of dentin beneath apparently sound enamel in the interproximal area, and at times the cavity is overlooked until there is a pulp exposure. Proper examination by radiogram will reveal these cavities before pulp complications occur. The prevention of periapical infection and destruction of alveolar bone is one of the greatest problems in dentistry today. Diseased pulps can often be identified by a disturbance in the normal picture of the periapical region. At least, any change from the normal will direct the attention of the operator to the tooth in question, and further tests can be applied. The location of subgingival calculus and improperly finished fillings can be determined to great advantage to the operator who is particular in his efforts to give efficient service; and many times, a second radiographic examination, at the close of his services, in an extensive case of reconstruction or treatment, will reveal to him corrections that should be made before dismissing the patient. In root canal operations, it is hardly necessary to state in this day, the radiogram is indispensable. From a minimum of three to as many as twenty films taken at different intervals during pulp treatment and canal filling are necessary. It is no longer necessary nor right to be satisfied with this service without the assurance of the result by this method of observation, and one who does not avail oneself of the advantage of a sufficient number of radiograms while operating on root canals is unnecessarily handicapped, and the patient is deprived of the most efficient service.

C. Edmund Kells, New Orleans, La.: Dr. Simpson's paper can be divided into two parts: the one a series of statements on dentistry in general, and the other, a treatise on the subject of the paper itself. In order to make this discussion as short and as much to the point as possible, I shall quote from the paper and follow the quotations with my comments thereon. Dr. Simpson states: " . . . the majority of dental repairs are a physical menace rather than restorers of function." That is an awful indictment of the dental profession. Dr. Simpson is a radiodontist, so from the very nature of his work, it cannot be a "menace" to his patients. Let me suggest that our guest modify the statement to read: "There are two classes of dentists. First class dentists comprise the first class, and the second class is made up of all the other dentists, irrespective of their classes." I am firmly convinced that the work of the first class dentists is not a "menace to their patients" but quite the contrary. It is a great factor in maintaining their health, when their health is good, and in restoring their health

when it is bad. We must admit that, unfortunately, "dental repairs" of dentists who are not in the first class often are a menace to their patients; therefore every endeavor should be made to educate these men out of their present classes and into the first class. Again to quote: "To avoid pulp involvement and limit the extent of repair, carious destruction must be discovered soon after the dentin is invaded." I cannot, for one moment, consider subscribing to such a statement. The enamel on certain teeth is certainly one-sixteenth of an inch thick or more. If this enamel were attacked by caries, Dr. Simpson would then have us watch it till "soon after the dentin is invaded" and then fill. Why waste all this time? I thought that it was the universal practice to attack caries just as soon as it started, the sooner the better. I fill a cavity long before it reaches the dentin, whenever it is possible to do so. Again to quote: "Radiographic examination discloses approximal caries with facility and accuracy, even in the incipient stage." My experience leads me to doubt this statement, and so far, no one has come forth with a practical demonstration which would convince me of this possibility. I am open to conviction, but until convinced, I must doubt it. I cannot do this myself. Who is there who will "show me?" Another paragraph: "To avoid disastrous complications, information regarding the relation of the pulp is essential in cavity preparation, and radiographic examination should be used for the purpose." Here, we are informed that in order to avoid disastrous complications, we must examine all cavities with the roentgen ray before filling. I doubt that any successful dentist in this organization will accept that statement. Take this statement: "The reproduction of the contact point, and the normal contour should be instinctive to the operator with proper training, yet it is not consistently done. Radiograms which give a profile view of the approximal surface, and its relation to the adjacent tooth, give opportunity for the correction of errors before harm is done." It will be interesting to see what Dr. Coolidge makes of this baffling statement. Once more: "If approximal amalgam fillings are radiographed after presumably being finished, and inlays and crowns are subjected to radiographic examination before cementation, there is opportunity for correction and a stimulus for technical improvement." Here, we are told that we must examine by roentgen ray all proximal amalgam fillings and inlays and also all crowns, and that, I believe, is carrying matters a little too far. Again, I say that I believe Dr. Simpson will find no one in this hall who will agree with him or will follow his advice. To summarize: We are instructed to await the penetration of the dentin by caries before filling the teeth. Dr. Simpson would have us examine all teeth by roentgen ray before they are filled, in order to avoid "disastrous complications." We must examine all proximal amalgam fillings, after they are inserted, and all inlays and crowns before they are permanently set. These ideas, I feel assured, are entirely beyond the assimilation of the ordinary dentist. I hardly consider it necessary, at this late day, for me to file a brief to the effect that I value the use of the roentgen ray. I am on record as saying that I believe that no dentist who has not a roentgen-ray machine at his elbow is in a position to do justice to his patients. Can any one go further than that? And yet, believing as I do, that the roentgen ray has its limitations, I cannot endorse these specific uses of it as advanced by Dr. Simpson. I would like it understood, however, that I honestly believe that no one values more than I any agent whatever that proves to be an "effciency and economic factor in operative dentistry." Dr. Simpson's intent, as shown by his most interesting paper, I fully approve. With some of his details, I cannot agree. However, we should thank him for having presented the subject as he has, because it will give some of us something worth while to think about. And now here is a thought that has just come to my mind while reading this essay. Dr. Simpson is a radiodontist. Notwithstanding the fact that he is the leading man in his specialty, he has no "home of his own" in this association of ours. The radiodontists (or the roentgenologists or the radiologists, whichever you will, because they have not yet decided as to just *who* they really are) are invited by first one section, and then another to take part in the program; as well they should be invited, because the part they take is an important one. The question is: Is it not high time, considering the value of the roentgen ray to dentistry, that it should have a section of its own? Is there any one

branch of our work that is more important than that of roentgenology? Should not the word roentgenology appear somewhere in the organization of the sections? If you would ask me this question I would say, "It certainly should." Now I will ask you that question and if *you* answer it in the affirmative and act accordingly, I will feel that my time in discussing Dr. Simpson's paper has indeed been well spent.

Dr. Simpson (closing): The slight periapical changes in the illustrations to which Dr. Coolidge called your attention were not mentioned, because the advanced destruction should be ample evidence of the operative errors. Dr. Coolidge seems to understand the motive and endorse the criticism of average dental repairs. As a teacher, he must have lamented the discrepancy between precept and practice. Dr. Kells takes exception to the statement that the majority of dental repairs are a physical menace rather than restorers of function. A majority is only more than half, and a menace is only a threat. Who will undertake to prove that more than half of dental repairs restore function? The criticisms in the paper are not maliciously intended, but the motive was to stimulate improvement. Dr. Kells opposes the more modern and refined applications of radiography in dentistry, but his contentions are not sound. Radiography has long since progressed from the "bone and bullet" limitations of its early use in medicine, and the abscess era in dentistry, so that it should be utilized to full advantage. In the discussion, Dr. Kells states that no dentist is in a position to do justice to his patients without a roentgen-ray machine at his elbow. Although the dentist is in this position, if he only poses, he will not do justice to his patients whether there is an x-ray machine at his elbow or not. Dr. Kells renews his appeal for the recognition of radiodontia by the American Dental Association. It would seem appropriate to recognize officially a specialty which contributes to every branch of dental practice, and has been accredited with a greater influence than any other factor in the progress of dentistry. A place on the program is of less importance in the development of radiodontia than the appreciation and cooperation of the profession. Until dentists learn the value of routine radiographic examinations, and discriminate in the quality of radiographic service, radiodontia will not have its deserved recognition.

SOME ESSENTIALS IN FULL DENTURE SERVICE*

By H. V. COTTRELL, D.D.S., Columbus, Ohio

EXCELLENT denture service may be said to emanate from a practitioner with a truly professional attitude of mind; one who is desirous of giving the best that is in him. There is no need of making the path rosy to get such a man to tread it; he will naturally take the way which will lead him to the best results.

It goes without saying that the shortest way to such an end is the most efficient. To reach such an end necessitates the recognition of certain fundamental principles: (1) complete restoration of facial lines, or esthetics, and (2) restoration of the functions of mastication and speech.

In order that either or both of the above mentioned fundamentals be fully satisfied, stability of the dentures must be provided at all times. Stability requires that retention be of such character that those conditions which tend to neutralize it shall be reduced as nearly to the minimum as is consistent with the desired result. For instance, complete reduction of leverage to the minimum may in some cases interfere with facial lines and phonetics.

The denture should cover the maximum area of mucosa, being limited only by movable reflected tissues, so that muscular action applied to these tissues will not overbalance the forces of retention. Their adaptation to these tissues should comply with the physiologic laws in that it should not unduly interfere with the nerve and blood supply. They should be so adapted that there will be a uniform distribution of force to the underlying tissues. They should be so constructed that the leverage to be applied to them when in function will not overbalance their retention.

All these things are obligatory on the dentist who attempts to make full denture restoration. The means by which they may be accomplished may differ as men are different. The principal thing that makes the difference is the technic of the operator.

The means by which I reach the desired end I shall attempt to describe here, and, in passing, shall give my reasons as far as I may.

I shall not discuss the preparation of the mouth further than to say that the least amount of trimming of the process should be resorted to that will permit compliance with the fundamental requirements before mentioned.

To build an upper impression, the

*Read before the Section on Full Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

pressure applied to the tissues in the palate should be reduced to comparatively low terms; hence, a tray should be built, preferably from tray com-

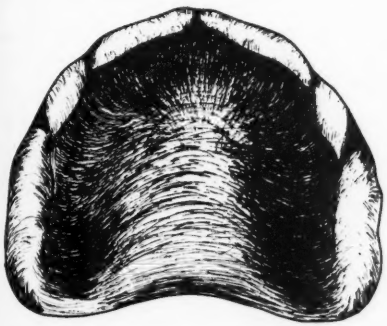


Fig. 1.—Snap impressions extending reflections.

pound, by taking a snap impression which will overreach the desired area. (Fig. 1.) This is removed from its carrier, and the border either muscle-trimmed by heating and reinserting, or arbitrarily cut down within 1 or

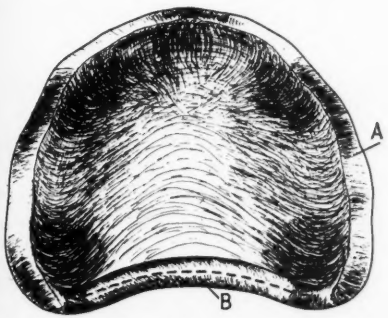


Fig. 2.—*A*, margin reduced to within 1 mm. of reflection at rest. *B*, carding wax post-dam laid on denture terminal.

1.5 mm. short of the desired termination of the impression. (Fig. 2*A*.)

The thickness from bicuspids to bicuspids is reduced at the expense of the labial side. Sufficient thickness is retained in the buccal regions to enable the final impression to fill entirely the space found to exist between the ridge and cheek when these tissues are at rest. (Fig. 3.)

Fig. 3.—Space between ridge and cheek when reflected tissues are at rest, which should be filled by the denture.

The line of junction of the hard and soft palate, or the terminal line of the denture in the palate, is designated on the compound, as shown by the muscle action in the soft palate. This line is covered with a layer of carding wax extending 2 or 3 mm. each way from it, and the tray, which this snap impression now becomes, is carried back into

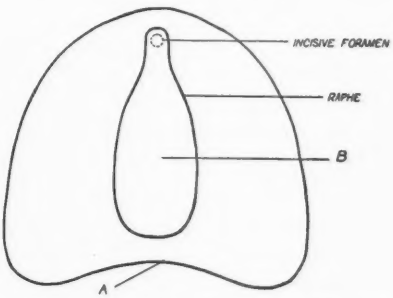


Fig. 4.—*A*, post-dam region. *B*, region of raphae plus incisive foramen included in relief.

the mouth with firm pressure, this insuring carriage of the tissues in the

post-dam region snugly against the bone. (Fig. 2*B*.)

The region lying between the terminal line and the posterior termination of the raphae is the region in which the post-dam should be laid. (Fig. 4*A*.) Any lapping of carding wax on the raphae should be removed, since the raphae itself may need relief. (Fig. 4*B*.)

The compound anterior to the wax post-dam is removed to the depth of 0.5 mm., and, in its stead, thin plaster is supplied and inserted into the mouth with firm pressure.

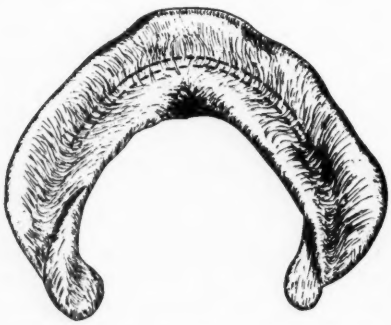


Fig. 5.—Lower snap impression with submerged wire reinforcement.

The tray is held with the index finger in the center, while, with the finger and thumb of the free hand, the cheeks are compressed with an anteroposterior swing of the hand. Thus, we muscle-trim the impression in plaster, and insure the desired slight pressure against the reflected tissues. The patient is instructed to bellows the cheeks to loosen the impression, which should present a continuous plaster surface.

The impression is treated with alcoholic solutions of shellac and sandarac, and the cast formed with some artificial stone that will permit the use of No. 4 tinfoil in the vulcanization process.

The end-result in the lower impression is similar to that in the upper, but is reached in a little different way.

The snap impression is taken, removed from the tray and reinforced by laying a previously fitted hot wire on the compound. (Fig. 5.) The

Fig. 6.—Snap impression trimmed short of reflection.

margin is trimmed with a knife to within 1 or 1.5 mm. of the reflected tissues, except in the so-called retro-alveolar region. (Fig. 6.) This region is described by Bowen, Neil and others, as being "bounded in soft tissues distally by anterior fibers of the internal pterygoid muscle which is covered by a loose, flexible curtain of mucous membrane, being concave laterally; above by the attachment of the pterygomandibular ligament; below, by the mylo-hyoid muscle." (Fig. 7.)

If, in taking this snap impression, these regions are not overfilled, com-

pound is added to the impression in these regions, one at a time, and it is carried back into the mouth. Immediately, slight pressure is applied to this region with the index finger, and while holding tray firmly in position with the fingers in the bicuspid region and thumbs under the mandible, the operator asks the patient to protrude the tongue from the mouth. On removal of this compound impression from the mouth, the act of protrusion will be seen to have partially turned the compound forward. This turned posterior edge is heated to a depth of 2 mm. with

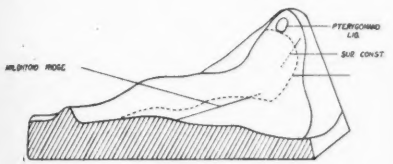


Fig. 7.—Broken line showing boundary of denture on the lingual surface.

a mouth blowpipe, is dipped in water at 140 degrees F. and reinserted, and the tongue movement is repeated. This should result in trimming the posterior edge of the compound. The lower edge of the compound is heated and inserted again in the mouth, so that the tongue will be carried into the opposite cheek as well as forward. This will trim the under portion.

From the alveolar surface, 0.5 mm. of compound is removed, without touching the retro-alveolar region. This completes the formation of the tray.

For insertion, the tray must of necessity be carried posteriorly until the retro-alveolar portion approaches the anterior pillar before being carried down and forward into position. Its removal will require the reverse procedure.

This procedure creates such an impression as is needed at this time. The only thing about it that is as it should be as it concerns the finished denture is the plaster impression of the crest of the ridge.

The cast is made as in the upper jaw for the construction of the denture. To finish this denture completely will require a rebasing procedure, which will be described later.

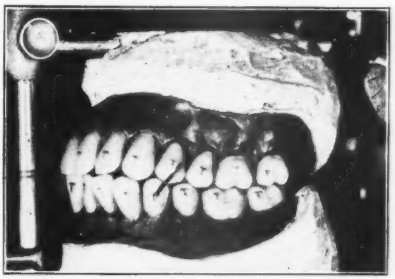


Fig. 8.—Denture showing line crossing the junction of opposing bicuspids when in lateral protrusion with the rotation centers 4 inches apart.

It is important that the relation between the maxilla and the mandible at rest and in function be recorded. From among the many ways of making the "rest" record, we prefer the construction of occlusion rims with base-plate wax reinforced by submerged metallic wire, because of the elimination of injury to the cast (which may occur through the use of a hard base-plate), and the ease and accuracy with which it may be applied to the occlusal surface of the cast. No danger to the form of the rim can occur because of its being

bendable, if one makes his observations quickly.

The occlusion rims are made to meet approximately midway between the occlusal surfaces of the ridges, each one being 2 or 3 mm. short of lip length. This line of junction then becomes the base line.

Fixing the relation between the occlusion rims with the mandible at rest is largely a psychologic question. A more or less passive state of mind must

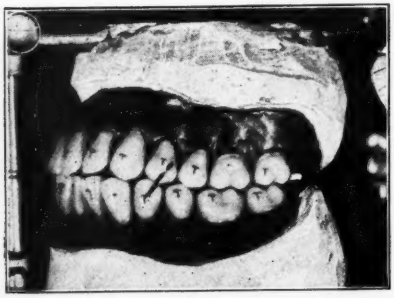


Fig. 9.—Denture showing rotation centers 3½ inches apart, with the black line slightly broken.

be induced in the patient—at least, a condition of relaxation of the muscles attached to the mandible is desirable.

When this relaxed state is reached and the rims are in the mouth, sufficient contraction of the muscles which lift the mandible is induced to cause the gentlest of pressure to be brought to bear against a layer of very soft wax which has been interposed between the rims.

If a plan for securing this record is preferred in which an appreciable pressure is brought to bear on the rims, rigid base plates must be used.

Attachment of the face-bow to the occlusion rims for mounting is a prime necessity.

After mounting the casts, a protrusive bite must be taken which carries the mandible forward 5 to 6 mm. This will record the forward path of the condyle.

In choosing an articulator for a case from among several adjustable modern instruments, all of which provide bene-

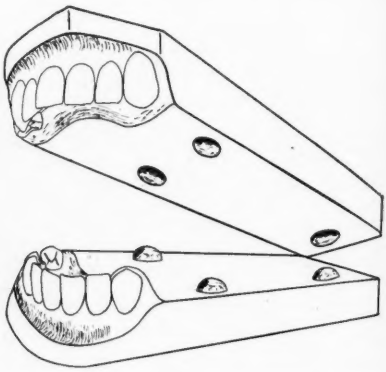


Fig. 10.—Relationship of anterior teeth prior to extraction.

ficial adjustable features, the reduction of the requirements of an articulator to their lowest terms will necessitate a condyle path adjustment.

This statement is made not to detract from the value of other adjustable features, but to emphasize the one of greatest importance. Omission of the others leaves more or less slight discrepancies to be eliminated by other means.

Since the incisal guide plane is only a convenience, and the rotation center adjustment eliminates a comparatively slight error in occlusal contacts in lateral protrusion (Figs. 8-9), and the

lateral condyle path is so little different from the forward path, it would seem that these discrepancies as stated above may be eliminated by a succeeding operation.

Where opportunity presents prior to extraction, certain records should be made for use later, such as an impression of the eight anterior teeth in each arch, which will show their relation in central occlusion and their relation to adjoining teeth. (Fig. 10.)

Fig. 11.—Profile record made by No. 20 soft wire prior to extraction.

A profile record should also be made. This may be done by the simple procedure of adapting soft wire, such as fuse wire No. 20, to the median line of the face, including nose, lips and chin. (Fig. 11.) This form is traced on paper for a permanent record. The wire is to be used in checking the profile when the dentures are being tried.

Teeth that are suitable to the case in form and shade should be selected, and the six or eight anteriors so arranged that the esthetics of the case are satisfied. At this juncture, the profile should be checked by application of the profile wire to the face.

The arrangement of posterior teeth is purely a question in mechanics, and should be so worked out as to present the maximum number of contact points in central occlusion.

In forward protrusion, the edge-to-edge contact of the incisors should be balanced by a contact of the second molars, which is made between the mesiolingual cusp of the upper and a triangular inclined plane on the lower leading from the central pit in the lower to the distomarginal ridge. (Fig. 12*AA*.)

Fig. 12.—*AA*, path of the upper molar cusp in gliding of the mandible from forward protrusion to central occlusion. *BB*, path of cusp in gliding of the mandible from lateral protrusion to central occlusion.

It is entirely unnecessary to establish contacts involving the teeth intervening between the working and balancing regions.

In lateral protrusion, the working side should show contacts of buccal and lingual cusps of opposing posterior teeth with the cusps of corresponding teeth; also the anteriors as far as the median line should be touching.

The balancing side provides sufficient contact when opposing second molars are touching in the same region as des-

ignated for forward protrusion, the only difference being that the path described by the mesiolingual cusp of the upper tooth on the inclined plane of the lower takes a distobuccal direction instead of a distal one. (Fig. 12*BB*.)

This technic requires the manipulation of two teeth only, in order to establish balancing contacts.

To make leverage safe on the lower denture, the second molar should be so placed in relation to the ridge that a perpendicular erected from the crest of

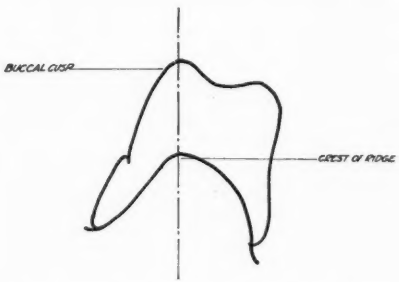


Fig. 13.—Relation of the lower molar to the crest of the ridge.

the ridge would bisect the buccal cusp of the second molar. (Fig. 13.)

The whole procedure will result in establishing an occlusal plane showing sufficient deviation from the horizontal to compensate for the requirements of the arbitrarily chosen overlap of the incisors working in conjunction with the predetermined condyle path.

The condyle path may be positive or negative. I have never seen a negative.

The completion of the waxing process should include: the registration of tooth form on the lingual of the upper teeth; the positional relation of anterior teeth which meets the needs of esthetics; the minimum and uniform thickness of the base in the palate. These will provide all the conditions necessary to restore phonetics.

We like to eliminate 50 per cent of the possible errors due to the laboratory procedures from this point on, by carrying the upper denture to completion ahead of the lower and checking them in central occlusion in the mouth before completing the lower.

Taking the check-bites requires that

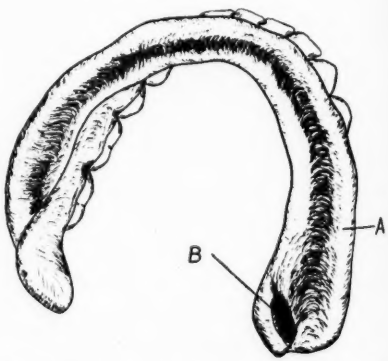


Fig. 14.—*A*, compound on the border of the denture base, extending toward the crest of the ridge. *B*, carding wax overlaid on the retro-alveolar region on the compound.

the lightest pressure possible be exerted on the wax, and that no contact of teeth with opponents be permitted.

Having completed the lower denture, the operator mounts both dentures on the articulator and spot grinds them for central occlusion. The cusps must not be shortened in this operation.

The case is now ready for rebasing the lower denture.

Undercuts in the saddle are removed back as far as the posterior end of the mylohyoid ridge. By the use of dry

heat, a good, modern compound is traced on the periphery of the saddle in sufficient quantity to form the border, and extended to the crest of the ridge, but not on it. (Fig. 14*A*.)

The retro-alveolar portion of the saddle is covered entirely. The entire mass is heated to the flowing stage, dipped in water at 140 F., and carried to the mouth. The teeth are closed in central occlusion and held there while the buccal and labial tissues are manipulated to trim this border. On removal from the mouth, any compound seen to be lapping on the crest of the ridge should be removed and the last operation repeated until the compound is seen to terminate in a very thin feather edge near the crest of the ridge.

This plan of obtaining a rebase impression will insure relief of pressure and unstretched tissues on the crest. (Fig. 15.)

The lingual border requires a tongue movement forward and into each cheek, as before described, to effect the proper trim.

The entire border is heated in short sections, and the seal perfected by careful manipulation of the border tissues in each section.

This procedure, when completed as indicated, will not show sufficient pressure on the retro-alveolar tissues in a lateral direction. The necessary pressure may be obtained by applying a layer of carding wax, possibly 1 mm. in thickness, to the compound in this region on both sides of the mouth at the same time, not, however, allowing the wax to reach the border of the compound. (Fig. 14*B*.) The denture is now carried back to the mouth and the patient is instructed to make tongue movements in all directions as before. These movements, if continued a few minutes, will help to adapt the wax to the tissues.

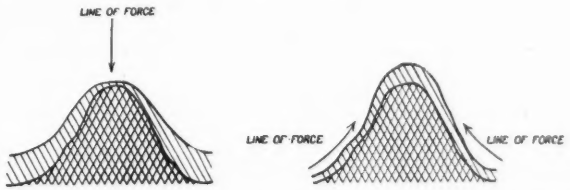


Fig. 15.—Effect on tissues covering the crest of the ridge when the rebase impression material is applied on the crest and when it is applied on the border.

If on applying hard biting stress to the incisors the tilting tendency of the posteriors is not neutralized, more wax is added and the operation is repeated.

After completion, the denture is again mounted in conjunction with the upper, and spot ground to the limit of the articulator's possibilities. It is then completed in the mouth, where all of the mandibular movements may be utilized, and many more than were contained in the records that we omitted to make at the mounting stage.

The total grinding necessary in following out this technic should modify the form of the teeth but slightly.

Some of these suggestions have been made in the hope that those of our gen-

eral practitioners who are easily frightened by a complicated adjustment scheme in our modern instruments, as well as those who are deterred by the necessary cost of such instruments, may see a way to reach the same goal as the most exacting practitioner.

403 Hartman Building.

DISCUSSION

I. V. Duell, Louisville, Ky.: Dr. Cottrell states: "The means by which we reach desired results differ as men are different, the principle thing that makes the difference being the technic of the operator," and, I will add, the amount of skill put into it. I wish to emphasize the importance of obtaining records of cases prior to extraction in the form of snap impressions, profile records, color of teeth, etc. Another good point brought out by Dr. Cottrell is the importance of retaining sufficient thickness in the final impression to fill properly the space existing between the ridge and cheek when these tissues are at rest. Omission of this is, I believe, an error commonly made. Dr. Cottrell has chosen to omit mouth preparation save to mention one of the most important principles, with which I heartily agree, that the least amount of trimming of the process should be resorted to; the future formation of the ridge should be encouraged over such a period of time as Nature requires for its repair unhampered by disturbing influences such as improper adaptation, or unbalanced occlusion, thereby affording every opportunity of rebuilding true bone, which she will do under normal metabolic conditions. Every case should be examined by roentgen ray before denture construction is attempted, regardless of how long it has been edentulous, and interpreted, not altogether for the location of roots, spicula, etc., but as an assistance in determining whether the condition of the tissues upon which we are about to build is favorable or unfavorable. Heretofore, it has been necessary to depend largely on digital examination for our diagnosis. Our ambition to develop perfect technic mechanically has blinded us to the advantage of the possibilities of radiographic interpretations. Fundamental factors governing good radiography must be added to our list of fundamentals governing denture construction if we are to render the most intelligent service. The most perplexing obstacle to overcome in denture-wearing patients is stabilizing bone metabolism, which must be controlled through proper surgical treatment and regulation of diet, together with continued balanced pressure. The success of mechanical construction depends on the foundation upon which it is built.

TISSUE CHANGES UNDER DENTURES*

By C. J. STANSBERY, D.D.S., Seattle, Washington

THE human body is composed of various tissues, and each of these is in turn made up of cells peculiar to itself. We are taught that, by cell division, the cells are constantly changing, and as the cell changes, so does the tissue. This holds true in all tissues of the body with the exception of the brain; here, cells are continuous throughout life.

The greatest tissue change problem is the problem whose solution will give the answer to the cause of aging or senility. To this basic question, the question of tissue changes in the mouth is but a corollary. As the tissues are but an aggregation of cells, the solution obviously lies in the changes of the cells, and these changes, in turn, are a manifestation of cell metabolism. Of the intrinsic differences between cells of youth, maturity and old age, we have but little knowledge. The gross changes are obvious.

The foremost difficulty that prevents our understanding the cell, its development, its life and its individual death is that we are but trying to analyze life itself, or vitality. Vitality is a form of energy not bound by the physical laws with which we are familiar and in whose terms we are accustomed to think; it cannot be changed into other forms of energy, and is subject ultimately to extinction. Here, the law of the conservation of energy does not hold; the real nature of the force called vitality is not known. We only know that, for a tissue to be vital, the protoplasm must have the so-called property of irritibility, and without it, protoplasm is just a complex chemical substance which, synthetically, as yet we have not succeeded in making.

With this premise, we see that, when a line of reasoning leads us through the realms of vitality, our conclusions must necessarily be based on some facts and considerable assumption; facts based on the observation of changes and assumption as to why change occurs. Some organs and parts of our bodies pass through maturity earlier and more rapidly than others. With the exceptions of the thymus gland and the female generative organs, there appears to be no time nor regularity in the order of their senile degeneration. Parenthetically, take note that the words senile and senility are not used to describe that period immediately preceding a person's demise but rather the entire time from the crest of maturity until death. Unfortunately, we are not made on the plan of the "one hoss shay;" some part always wears out first.

When healthy tissue normally used begins to atrophy, we may expect to find the cause in a nutritional fault brought about by an impaired blood-

*Read at the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

supply. The atrophy of healthy tissue abnormally used we may expect to find to be due to abnormal use or an impaired blood-supply, and usually the impairment of the blood-supply the direct result of the abnormal use. The older the tissue the less readily can it accommodate itself to functional deviations from normal and the more quickly it degenerates. The physician looks on old age as he does childhood. He does not consider a child an adult with undeveloped organs, nor does he treat the child's disease as an adult's disease complicated by immature development. A pulse of 120 does not mean that an infant is ill, nor does his inability to reason make him an idiot. These conditions are natural and normal to the child, but would be unnatural, abnormal and pathologic in the adult. He also does not consider the tissues or infirmities of old age on the basis of robust maturity but as conditions entirely peculiar to the aged.

We must take a similar view in studying an edentulous mouth and a normal one. Although advanced years are not always a persistent accompaniment, in edentulous mouths we have an abnormal use to which tissue changes can be attributed. We must look on the atrophy and change of tissue character that take place in the edentulous mouth as natural and normal to this condition and not expect conformity to the condition of a mouth containing its complement of teeth.

One of the first signs of senility of the skin is its looseness and tendency to produce wrinkles, owing to the loss of the underlying connective tissue. As the mucous membrane is closely allied to the skin, it is not an unreasonable conclusion to draw the analogy of the loss of connective tissue under the mucous membrane. But the loss of connective tissue in senility is not an established fact; for, in some instances, we have the contradictory fact that the connective tissue in various parts of the body increases with senility, as in the interstices between the muscle fibers and within the kidneys. From the foregoing, it will be seen that tissue changes under dentures should be considered primarily as a reflection of general health and only secondarily as the effect of the aggravation of an artificial denture. In our consideration of adverse tissue changes, we cannot but admire Nature's tolerance in taking so kindly to our mechanical contrivances.

In every case of tissue repair, the new tissue is of lower order, requires less blood, and is incapable of doing the work of the original tissue. The application of this fact must be recognized in the repair of the alveoli and the surrounding tissue. Previous to the extraction, the gingival line of tissue is nourished by the terminal capillaries of the anterior palatine artery on the lingual side of the teeth and of the alveolar branches of the internal maxillary on the buccal and labial. This is the normal amount of tissue which these capillaries should nourish. After extraction, to this is added the new tissue laid down in the alveoli and that covering the ridge. Scar tissue and that supplied by the extended blood-supply does not have the resistance of the normal. It should now be very apparent that even before an artificial denture is inserted, we have a deviation from normal upon which to build our restoration.

That Nature never intended the mouth to wear an artificial denture is

self-evident. The fact of its presence being a necessary evil should not deter us from giving it due consideration while weighing the different factors that enter into our problem. As a starting point, we may measure the deviations from normal chargeable to artificial dentures by enumerating the conditions imposed upon the tissue by their insertion and the subsequent results of these conditions. To do this, first outline the conditions of a healthy mouth with its full complement of natural teeth in proper functional condition that we may have a norm from which these deviations may be measured. In the foregoing healthy condition, all trauma, and that a natural trauma, is absorbed by the resilient architecture of the supporting bony structure and converted into a stimulation accruing to the health and development of the bony structures themselves. The excursions of food over the tissues can hardly be considered as in any degree traumatic but rather as massage, and no doubt as necessary to the maintenance of proper health of the oral tissues as is the air massage to the nasal membranes and the sinuses of the head. The roughened surface of the tongue is in constant movement against the oral tissues and, bathed with ever-changing saliva, it cleanses, scours and stimulates. Furthermore, every time we swallow, we create a suction against the tissue which acts to empty forcibly the mucous glands. This by no means exhausts the factors in the beneficial environment that the tissues of a normal mouth enjoy and, if we concede Nature's way to be the best, we may say that all natural conditions redound to the welfare of the tissue.

In contrast to the foregoing ideal, let us suppose artificial dentures are introduced and take inventory of the conditions which necessarily follow their insertion. To make the comparison more obvious, let these dentures be of such mediocrity that all the faults of materials and construction can be assigned to them. First, the errors of a poor impression will be reproduced in the finished denture and may be responsible for irritations, circulatory interferences and effects of pressure on the trophic function of the underlying nerves. This reference to trophic function is somewhat of an assumption, as the trophic function of a nerve is not clearly established. We have tissues that do not seem to suffer any degree of atrophy when the sensory nerve is paralyzed; the same is true of motor supply. Also, lower orders of life grow and are nourished when no nerve tissue can be demonstrated.

In impression taking, undue pressure and compression of the softer areas of the mouth should be avoided, for under these areas lie the blood and nerve trunks that supply the adjacent parts. In any tissue, there is a certain proportion of cellular tissue to vascular volume. A so-called compression of tissue is but a diminution of the vascular content, the contents of the arteries and veins being expelled. The normal balance between the vascular capacity and the tissue to be nourished is thereby disturbed. It is axiomatic that, to preserve the health of any tissue, its blood supply must be normal and uninterrupted, and the tissues underlying a denture are no exception. No doubt this balance is soon reestablished by a lessening of the tissue or an absorption of the underlying bone, and it seems that, when the latter happens, it

may, once started, persist to such an extent as seriously to affect the foundation and stability of the denture.

Secondly, improper vulcanization with its roughened surface and porosity gives rise to an attendant train of conditions including irritation and accumulation of débris, and provides the requirements for a most ideal environment for bacterial growth and this growth held in close proximity to the tissue. To just what extent this affects deleteriously the health of the underlying tissue is a matter of conjecture as, in some instances, we find angry, red, diffuse inflammation and, in others, apparent good health.

Thirdly, there are the structural defects of the denture, such as lack of functional articulation and improper restoration of maxillomandibular relation, with their resultant improper lines of masticating force and strained relations of adjoining anatomic parts. One of the most commonly noted conditions of improper restoration of relations, with its accompanying protrusive thrust in masticating, is the broken down and cartilaginous-like anterior ridge. Here, we have the bone, designed to withstand a strain in the direction of the long axis of the natural tooth, subjected to a force at almost right angles to the direction intended. As a fourth consideration, there may be added the effects of lack of temperature change of the tissues covered by a nonconducting denture material. Whether or not the tissue is kept warmer or cooler than normal is a matter of discussion, but lack of stimulation due to temperature change is certain. This greatly reduced conductivity of thermal change one may well call the interference with the temperature massage of the underlying tissues.

As in other branches of dentistry, the greatest good to our patients comes through prophylactic rather than restorative measures. The general health of the patient is the greatest single factor in the health of the mouth. Other than to make efficient dentures and thereby raise the patient's resistance through the channels of better nutrition and improved health, it is not possible to correct detrimental tissue changes that have already taken place under the dentures. Let us not allow this established relationship between general health and mouth conditions to lessen our efforts to avoid all needless aggravation of supporting tissues.

To avoid these conditions, we must look to constructive criticism of many of our present-day procedures. From the foregoing list of conditions which have their effect in producing deviations from normal, we shall proceed to eliminate as many as we can, and we shall further scrutinize those remaining in an endeavor to alleviate them. Obviously, for logical sequence, we must begin at the time of the extraction and give attention to the ridge formation and its investing tissue. Here, as much as possible of the normal tissue previously adjacent to the teeth should be utilized surgically to obviate the need of new tissue being formed. On the maxillary ridge, the lingual tissue, having a greater natural resistance to the excursion of food, is more desirable as a covering for the crest of the ridge than is the buccal or labial tissue. In the preparation of a ridge there is presented the prime opportunity and necessity for exercising mature judgment. Undue interference with the

blood supply of the newly formed ridge can be somewhat controlled by the technic employed in impression taking. This relief for the circulation was one of my chief objectives in giving to the profession my negative pressure technic of impression taking.

Among the materials for denture construction, I consider vulcanite one of the worst. If in any textbook you will refer to the advantages and disadvantages of vulcanite you will find the advantages are all for the dentist and the disadvantages for the patient. With the substitution of a metal base, the roughened surface and porosity of vulcanite is eliminated and the accumulation of débris is lessened, and, with the alloy suggested by Dr. Pryor of Cleveland, we may even have an inhibitory effect on the bacterial growth. This will tend to allay the irritations that are chargeable to these bacteria held in contact with the tissue. A metal base will also go a long way toward reestablishing the conditions of proper thermal change. The correct arrangement of the teeth for balance will properly direct and distribute the lines of force over the entire denture foundation, thus contributing to comfortable mastication and preventing the likelihood of inimical tissue reaction. A denture may be the primary cause of some transitory complaint, but, as a rule, it constitutes but the secondary or contributing factor to a general condition so lacking in vitality and resistance as to bring about tissue changes which would otherwise not be evident.

There still remain a few conditions not amenable to improvement. Under this head are the cleansing action of the tongue against the tissues, the excursion of food across them and the suction on the mucous glands; all precluded by the presence of the denture itself. These conditions under the denture will be recognized as having a physiologic aspect too profound to be passed over lightly. The cleansing action of the tongue brings about the very antithesis of that which we find under a denture. With a denture in place, the tissue, copiously supplied with mucous glands, not only lacks the suction to aid in their evacuation but also must overcome the obstruction of the denture itself.

Changed tissue is the patient's contribution to the ultimate denture service. The denture is the dentist's contribution. Neither is responsible for the other's part.

THE CAUSE AND THE PREVENTION OF DENTAL DECAY AS INDICATED BY A SURVEY

By HAROLD F. HAWKINS, D.D.S.; W. W. HENDRICKS, D.D.S., and N. R. HILLS, D.D.S., Los Angeles, California

IN presenting this survey it is hoped that a step will be made in the elimination of unimportant factors in the causation of dental caries and that attention will be fixed on those forces and factors that seem to be all important, to the end that a working basis for the control of dental decay may be established.

This survey was begun in the summer of 1922 and was completed in the early spring of 1926. In the year that has elapsed since the completion of the survey and its tabulation, we have endeavored to prove or disprove the important factors, as suggested. While our experiments and checkup work are still in progress and probably will be so for some time to come, we have found nothing to shake our faith in the importance of certain indicated factors. It has been thought wise to present the survey at this time rather than to hold up its publication for the future.

In approaching the study of dental caries, we thought that it might be more illuminating to conduct a systematic survey and reserve animal and test-tube methods until after the completion and study of our tabulation. In this, it was hoped to bring out the important and eliminate the unimportant factors, and perhaps disclose some hidden factors.

The plan of the survey was as follows: The material was gathered from the junior and senior students of the College of Dentistry, University of Southern California. The students were divided into three groups. The first group was made up of those who had no signs of dental decay or fillings at the time the student's history and record were taken. The second group was made up of those students who were free from decay or fillings at the time of enrollment in the college, but who developed dental decay before they had reached the junior year. Two histories of this group were taken; the first before they had begun their dental studies, and the second at the end of the two-year period from enrollment to the beginning of the junior year. The third group comprised those students who had always been troubled by considerable caries both before and after enrollment at the institution. A student was not placed in this group unless he had ten or more cavities or fillings.

The students' histories were tabulated in their respective groups, and for the sake of clearness and comparison, a circle was used in all tabulation if the subject was immune and a cross if he lacked immunity to caries. Hence, the tabulation in Group II will present two characters: the circle to cover the history before entering college (being the

period of immunity), and the cross to cover the history when subject to dental decay. The use of different characters permits a nice correlation between the different groups. Group I should correlate with that portion of Group II that covers histories before entering college; while that portion of Group II represented with a cross, covering the student's period of susceptibility, should correlate with Group III. If a careful study now is made between the tabulation represented with circles and that represented with crosses, the importance of the item under consideration will be clearly indicated. The different items or headings under which the tabulation was made were selected after a careful study of the individual history charts, as well as with the thought to make the tabulation as broad as possible as to general habits, heredity, health, conditions in the mouth, a suitable diet and elimination.

We may take up the individual headings as follows:

The heading "No." is our record number covering a particular student's history.

Caries.—Under "Caries," we have endeavored to show whether the subject was immune or not. Group I shows no caries. Group II shows no caries until the student entered school, and under "Yes," the number and types of cavities (Black's terminology) developed before the junior year are shown. Group III shows types of cavities represented.

Health.—"Health" refers to the general health, up to the time the histories were taken, under the headings of "Good," "Average" and "Poor." Group I shows a state of very good general health. Group II, up to the time of entering school, has not so good a showing as the first group, and, after

TABLE 1.—FINDINGS IN GROUP I*

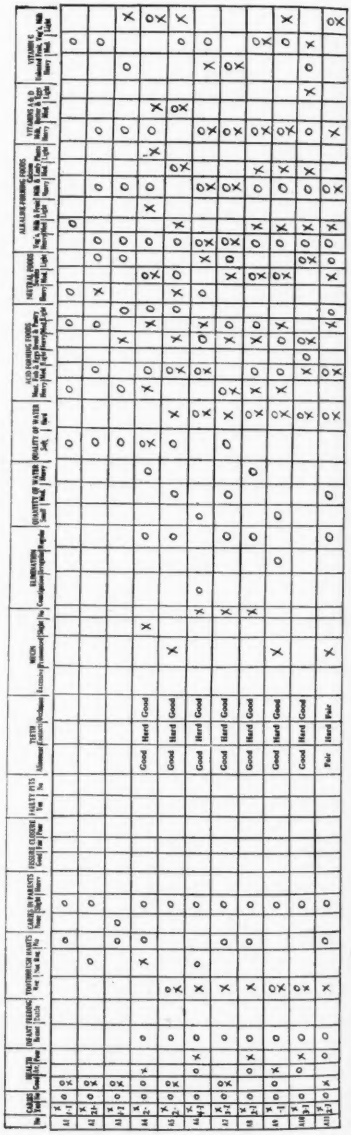
No.	CARIES	HEALTH	DEFECT	TOOTH BRUSH	TOOTH POWDER	PASTE	CARIES IN PARENTS	FISSURES CLOSED	FAULTY FITS	TEETH	MOUTH	ELIMINATION	QUANTITY OF WATER	QUALITY OF WATER	ACID FORMING FOODS	NEUTRAL FOODS	ALKALINE FORMING FOODS	VITAMINE A & D	VITAMINE C
1		O		O			O					O		O					
2		O		O				O											
3		O		O				O											
4		O		O			O												
5		O					O			Good									
6		O		O						Good	Hard								
7		O		O			O			Good	Hard								
8		O		O				O		Good	Good								
9		O		O				O		Good	Good								
10		O		O			O			Good	Hard								

two years in school, about half the subjects had a still poorer showing. Group III shows that the state of health was only slightly inferior to that of the second group on entering school.

Infant Feeding.—This refers to whether the student was a breast or bottle fed baby. Group I, that is, all but one whose data we were able to obtain covering this item, were breast fed. Group II, all recorded, were breast fed. In Group III, the showing in favor of breast feeding was not so good. It would seem that breast feeding is a favorable factor in immunity. Whether it is due to an increased hardness of the teeth or to a better state of general health we do not know, but we are inclined to believe the latter is the more probable cause.

Toothbrush Habits—These habits are recorded under "Regular," "Not Regular" and "No," referring to the use of the toothbrush. In the latter classification, some had toothbrushes, but very seldom if ever used them, while others, strange to say, never owned a toothbrush until after entering college. Group I is about equally divided between regular and no use of the toothbrush. Group II inclines even more strongly toward no use of the toothbrush. Group III makes a much better showing in the use of the toothbrush than either of the other groups. When we study the tabulation in this group together with the increased regularity in toothbrush habits as seen in Group II when immunity was lost, it would seem to imply that the use of the brush increased the tendency toward dental decay. This, we believe, is not the correct interpretation, but rather that the toothbrush as ordinarily used is a very poor weapon in the prevention of dental caries.

TABLE 2.—FINDINGS IN GROUP II*



*O indicates immune; X, susceptible.

Caries in Parents.—This is recorded under none, slight and heavy. An effort was made here to ascertain the heredity factor. As seen in Group I, slight caries predominates. In Group II, slight caries also predominates. In Group III, all parents had extensive or slight caries. As we analyze the three different groups, there seem to be two possibilities: either there is an inheritance factor, or the children have acquired the faulty dietary habits of their parents. The latter is, we believe, more probable.

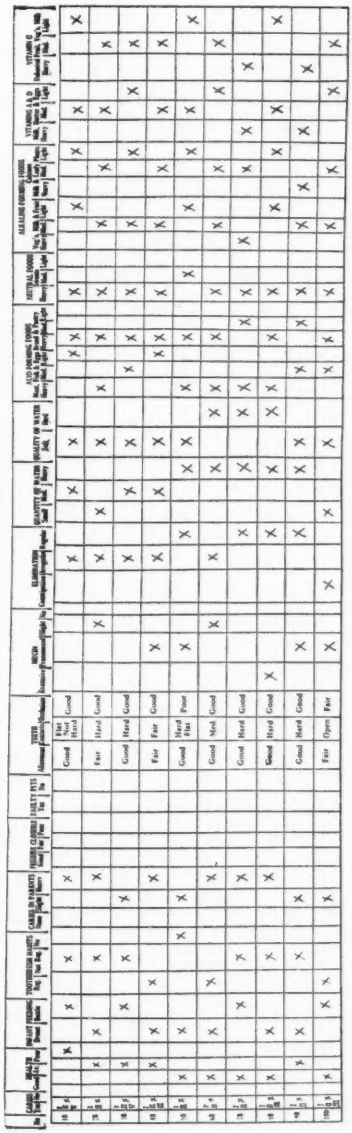
Fissure Closure.—An effort was made to ascertain the condition of the fissures under the headings of good, fair and poor. Group I we found had very good fissures. In Group III, on account of the great number of fillings, an accurate estimate could not be made, so this line of research was abandoned.

Faulty Pits.—In Group I, about two thirds of the teeth examined had faulty pits of such depth as to be absolutely noncleansing. In Group III, it was impossible to make an examination on account of fillings.

Alinement, Contacts and Occlusion.—Group I was uniformly good. Group II was equally good. Group III, while not so good as the other two groups, as can be seen, was still much better than fair. It does not seem possible, as far as this survey is concerned, that the alinement, contacts and occlusion of the teeth concerned were much of a factor.

Mucin.—This has been suggested as a contributing factor in caries. An effort was made to check up on this point. Physical methods of measurements were used. The headings are "Excessive," "Pronounced," "Slight" and "No." In examining Groups I, II and III, it will be seen that there is a decided tendency for mucin to be

TABLE 3.—FINDINGS IN GROUP III*



*O indicates immune; X, susceptible.

a little stronger in the immune than in the nonimmune. We have other surveys covering this point which bear out the trend shown here. We believe that the presence of excessive mucin is a favorable sign, inclining toward immunity rather than otherwise.

Elimination.—This refers to bowel action and is tabulated under constipation, irregular and regular. Comparing Groups I, II and III, a fair degree of uniformity exists between the different groups. There does not appear to be anything here that might have a bearing on the subject.

Quantity of Water.—This was measured over a twenty-four-hour period and is tabulated under small, medium and heavy. There is a fair degree of uniformity between the different groups which would eliminate the quantity of water as a factor. However, there is a nice correlation between the quantity of water consumed and the elimination, which is quite interesting, although having a bearing on caries only in its relation to the general health. Those who consumed a small amount of water had a tendency toward constipation, while those who consumed much water were usually of regular habits.

Quality of Water.—This was considered as to hardness and softness. The test that was used was to determine whether or not it was necessary to break the water for washing purposes in the home. In comparing the different groups, a fair degree of uniformity was found to exist, which eliminates the hardness or softness of water as a factor in caries. This was a surprise to us as we had expected hard water to have a favorable influence toward immunity.

Acid Forming Foods.—This heading refers to the acid ash found in this class of foods, an important factor in a certain type of acidosis. The research covering this point was performed by Sherman and Gettler and confirmed, in man, by Blatherwick. In considering meat, fish and eggs, which are strong acid-forming foods, we find a fair degree of conformity between Group I, II and III. We note a tendency, in Group II, when immunity is lost, toward a slightly increased consumption of this class of foods. In the consideration of bread and pastry, we find quite a striking difference between the various groups. There was a strong correlation between Group I and Group II before immunity was lost, and an equally strong correlation between Group III and Group II after immunity to caries was lost; in other words, we see in Group II that, when the consumption of bread and pastry increases, caries results. Bread and pastry have two actions: a systemic action due to their acid ash, and a local action due to the strong tendency to produce acid by fermentation. Meat, fish and eggs have a much stronger acid ash than bread and pastry. We have previously shown that there is only a slight tendency toward decay with meat, fish and eggs; hence, the action of bread and pastry must be chiefly a local one. This we consider a confirmation of Miller's acid theory of dental decay.

Neutral Foods.—These consist of pure sugar, starch and fats. As sugar and sweets have stood uppermost in the minds of many as a big factor in caries, it was decided to let sweets represent this class of foods. In comparing the different groups, we find a striking

difference. In Group III, we find a heavy consumption of sweets; while in Group I, the general tendency is toward light or medium consumption. In Group II, we see a slight tendency for the amount of sweets to be increased as immunity is lost. This bears out the general impression in the dental profession that sweets are a contributing factor in dental caries.

Alkaline Forming Foods. — This heading covers that class of foods which has a basic ash and would tend to overcome acidosis. We have divided this general heading into two subdivisions. An effort was made to separate, if possible, those foods that have a high value in overcoming acidosis from those that had a high calcium content. It was necessary to place milk in both divisions. As we consider vegetables, milk and fruit in Group I, we are impressed with the heavy consumption of these products by the immune. We find in Group II that there is a heavy consumption of these products before immunity was lost, but a strong tendency to consume less of these products when caries develops. We see in Group III a tendency to consume much less of these foods. It plainly appears that this class of alkaline forming foods are a requisite in preventing dental decay in the American diet. In considering the calcium subdivision, milk and leafy plants, we are impressed with the fact that the same correlation exists as to the different groups as exists in vegetables, milk and fruit. We are inclined to believe that the calcium intake is also an important factor, and in some diets, all-important. The diet of the Mexican people gives a nice illustration of this. They are indifferent consumers of fruit and vegetables, but heavy consumers of meat, beans and corn products. The corn is prepared by heating in a solution of air slaked lime. The corn is then ground up and seasoned, and is known as tamale meal. This is consumed as so-called hot tamales or tortillas, small cakes cooked on air slaked lime instead of in grease or fats, considerable of this lime adhering to the cakes. The amount of calcium consumed by the Mexican people is enormous. When living on his native diet, the Mexican is practically immune to dental decay, but as can be expected, he suffers from heavy salivary deposit. It has been shown by modern research that inorganic calcium can be utilized by the body about as well as the organic form.

Vitamins A and D.—The so-called fat soluble vitamins are found largely in the fat of milk, butter and eggs, as well as in certain types of vegetables. Milk, butter and eggs are our chief fat-soluble vitamin foods. In Group I, we find the immune heavy consumers of these foods. In Group II, we also find them heavy consumers of these products. When immunity was lost, we see only a slight tendency toward a smaller consumption. In Group III, we find a much lighter consumption of these foods. In comparing Group I with Group III, we are at once impressed with the greater use of the so-called fat-soluble vitamin foods in the first group. The fat-soluble vitamins are given credit for having a desirable influence on calcium assimilation.

Vitamin B.—Because the antineuritic vitamin, B, is so widely found in our foods and also on account of its thermostaple character, it was deemed not at all likely that there could be any

marked deficiency in the average diet. For that reason, it was not made a part of this survey.

Vitamin C.—The antiscorbutic vitamin, C, is found chiefly in uncooked fruits and vegetables. The vitamin is readily oxidized, and heating increases this tendency greatly. Certain fruits, such as the citrus fruits, are particularly rich in this vitamin. In considering these foods, it must be borne in mind that they are also alkaline-forming foods as well. Group I shows a slight preference for this class of foods. Group II also shows this tendency, but when immunity was lost, a slight tendency to reduce the consumption of these foods is seen. In Group III, there is a tendency to show a slightly lower consumption than is shown in Group I. As there is no marked tendency to line up strongly in the tabulation, and keeping in mind the alkaline forming property of these foods, we are compelled to believe that Vitamin C does not figure in dental caries.

SUMMARY

In checking up on those factors that seem to have a bearing on decay as covered by this survey, we would like to emphasize the following facts:

1. The general health of the individual is a result of his dietary habits and, moreover, it contributes in some degree for or against dental caries.

2. Breast feeding contributes to a better state of general health, but the absence of it does not of itself contribute largely to a lack of immunity.

3. The toothbrush as usually applied is not an effective instrument for the prevention of dental decay.

4. Heredity is probably not a great factor, but the faulty dietary habits of the parents are acquired by the children.

5. Faulty pits existed in a high percentage of the immune; hence, structural defects are not the primary cause of caries, but may be the starting point when immunity is lost.

6. Alinement, contacts and occlusion, when good, no doubt contribute to immunity, but poor alinement, contacts and occlusion were not operative in those lacking immunity in this survey. Group II compared favorably with Group I, but they lost their immunity from other causes.

7. A high mucin content of saliva is more often found in the immune than the nonimmune, and, hence, is not an adverse factor in dental decay.

8. Acid-forming foods in the form of meat, fish and eggs are probably only a slight factor, but, in the form of bread and pastry, are one of the direct causes of dental decay. This is no doubt due to a local acid fermentation.

9. The survey shows a heavy consumption of sugar to be another cause of caries. This may be due to local or systemic factors or a combination of local and systemic action.

10. The importance of the alkaline-forming foods is very apparent; in fact, they can be said to be a prime requisite in the prevention of decay, as the tabulation clearly shows this. The elimination of acidosis, the creation of a high alkaline reserve, with a strong alkaline saliva that usually results therefrom, is a great safety factor. This alkaline saliva would naturally combine with any free acids of the mouth, neutralizing them. The greater the fermentable food pabulum in the mouth, the greater the alkalinity of the saliva would have to be in order to prevent caries. The calcium level could act in

the same way; a high calcium content of the saliva would tend to neutralize mouth acidity.

11. The so-called fat-soluble vitamins A and D are shown by the tabulation to be factors. They are given credit for having a desirable influence on the endocrine system in maintaining a higher calcium level. If that is true, they are then important factors in immunity.

12. Vitamin C, or the antiscorbutic vitamin, does not appear in the tabulation to be a factor. We feel sure that it does not figure in dental caries.

CONCLUSION

To prevent dental decay, as suggested by this survey, the following procedures are indicated: Alkaline-forming foods, such as vegetables, fruit and milk, should be abundant in the dietary. If the leafy type of vegetables are eaten in generous quantities, and coupled with a liberal quantity of milk and a sufficient amount of fat-soluble vitamins, the calcium level of the body will be kept on a higher plane, which is an additional safeguard. The acid-forming foods, such as meat, fish and eggs, can be eaten in reasonable quantities; but bread and pastry should be kept at a lower level. The use of potatoes instead of much bread is decidedly indicated as potatoes are alkaline forming and tend to prevent acidosis. They also do not tend to stick to the teeth as do bread and pastry products. This adhesiveness is probably due to the high gluten content of wheat, which is not soluble in the normal saliva. A very light sugar and candy consumption especially for children is decidedly indicated. The use of butter and eggs, together with milk in fair quantities, will probably meet the fat soluble vitamin demand, especially in adults. The use of cod-liver oil would not be a bad prophylactic measure with children.

Miller's theory may be expanded to express the indicated local and systemic factors thus: Dental decay is the molecular disintegration of the hard tissues of the teeth by unneutralized acids of fermentation due to a lack of basic or acid neutralizing salts in the saliva.

SURGICAL CORRECTION OF PROTRUSION OF THE LOWER AND UPPER JAWS*

By F. KOSTECKA, Prague, Czechoslovakia

THE wonderful results achieved by plastic surgery in the World War had beneficial effects on dental medicine. Plastic surgery found a remunerative field of activity in the therapy of abnormal occlusion of the teeth, particularly in protrusion of the jaws.

All these deformities, as they develop, disturb the harmony of the face, the function of the teeth and the speech, to such a degree as to fill the persons affected with embarrassment and to keep them from company to avoid unpleasant remarks.

We know, of course, that the anomalies of occlusion are easily corrected in youth by conservative orthodontic methods, but we also know that orthodontists refuse treatment in many adult cases as it would be unsuccessful. It is impossible to let these cases run their unhappy course. If orthodontia cannot cure them, it is the duty of plastic surgery to take care of these cases. A number of prominent surgeons—Hullihen, Blair, Cryer, Berger, Jaboulay, Berard, Badcock, Eiselberg, Pickerill, Brophy, Lane, Pichler, Lindemann, Vikolsky, Limberg and Ernst—took part in the solution of this problem and contributed to successful correction of these anomalies by way of surgical therapy.

However, we must not forget that, in surgical therapy, we are at a certain disadvantage as compared with the condition existing in orthodontic treatment. While orthodontic treatment, if necessary, may be extended to the whole set of teeth, it being possible to model by the movement of the teeth both the upper and the lower jaws, with consequent automatic correction of the muscles of expression; in a surgical operation, we are limited to a comparatively small portion and, therefore, we are forced to correct only the part which is most important for cosmetic and functional effects.

It is definitely established that we can obtain almost complete success by means of surgical therapy in some cases by removing the chief deformity, as, for instance, in cases of protrusion in which the chief defect is in the lower jaw.

The shape of the dental arches in cases of protrusion is usually almost unchanged, and the anomaly can be corrected by a distal movement of the lower jaw.

Formerly, surgeons attempted to force back the lower jaw in cases of protrusion either by cutting out a portion of the mandible in the region of

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

the bicuspids or molars or at the angle of the lower jaw. This operation had its disadvantages: discontinuation of the lower alveolar artery and nerves, the long skin cuts, and the possibility of an infection from the mouth in case the mucous membrane was cut. All the alleged disadvantages can be avoided, if we cut the mandibular ramus on both sides in the region between the mandibular foramen and mandibular incisura horizontally. In this operation, it is not necessary to remove the bone; the nutrition and innervation of the jaw remain intact, as the cut goes above the mandibular foramen and there is no danger of cutting into the mouth cavity.

Using this method I recently operated in five cases without the slightest accident, obtaining a good cosmetic and functional result. I can sincerely recommend it, as have other authors.

Surgery has a still more difficult task in the treatment of prognathism. In this anomaly, there are a number of functional and cosmetic defects combined. The upper row of teeth is narrower; the palate usually high. The anterior upper teeth, with the alveolar process, are very prominent; the lower jaw is drawn back, and the lower incisors stand in supraclusion.

The main difficulty in orthodontic therapy in the case of patients older than 15 years is the movement of the lower jaw and the fixation of the lower jaw in this position.

In such cases, where it is possible to regulate the upper jaw, the surgeon has the task of forcing the lower jaw forward. In Blair's book, there is a detailed description of this operation. It consists in cutting the lower jaw in its ramus, on both sides similarly, as in protrusion, with the exception that we do not move it backward, but forward. I am convinced that the orthodontic therapy is accelerated by this operation and crowned with permanent success.

There are still many cases left in which orthodontic treatment cannot be given either because of lack of means for anchorage in the upper jaw, particularly of molars, or in the case of advanced age or because of lack of time or financial means.

I observed that the persons afflicted with prognathism complained chiefly of the odd appearance of their faces because of the projecting anterior teeth and alveolar process in the upper jaw and that they requested removal of at least this defect.

Gunther Cohn-Stock attempted in two cases of prognathism to correct the defect by the extraction of the upper cuspids and chiselling the jaw sagittally in the gap left by the extraction of the cuspids. In the palate, he cut in the palatal cortex horizontally a wedge connecting both sagittal cuts, and afterwards forced the alveolar process with its incisors backward, and fixed them. In two cases, I proceeded similarly, but I realized that after the incisors were forced in, they came too far down and the lower teeth soon pressed the fragment back into the original position.

Therefore, I attempted, on a model, to push the protruding anterior part of the upper jaw into a normal articulation, and I realized that it is necessary not only to push the anterior part back, but also to shorten the alveolar process in order to make it possible to retract the anterior teeth with the alveolar process, and also bring the latter upward. Thus, the anterior teeth would not show below the upper lip when the mouth is closed. At the same time, a good articulation is obtained. I proceed in the following way: After making a

model of the cuspids of the upper jaw in plaster, I insert the frontal segment with the teeth in the best possible position. I prepare a splint, which is fixed to the bicuspids. I also try to attain in the mouth of the patient the same conditions as on the model and perform the plastic operation under local anesthesia in approximately the following way: On the labial side of the alveolar process after the mucous membrane and the periosteum have been lifted the extent of the anterior teeth, I chisel the alveolar process sagittally in the spots where I extracted the cuspids, as far as the palatal periosteum and then in the upward direction several millimeters above the roots of the incisors. With a horizontal cut, I unite the sagittal cuts several millimeters above the roots and extend the cut through the whole alveolar process as far as the palatal periosteum. The whole frontal segment of the upper jaw becomes free and can be pushed back.

By bringing the segment back, we do not yet obtain good results, and it is still necessary to cut away a portion of the bone below the nasal spine in the horizontal direction and not until now can we move the entire frontal segment cranially and lingually. After adjusting the separate frontal part into an ideal position, I cement the splint which I have prepared on a model, and suture the cut on the labial side. The mucous membrane and the periosteum of the palate are not injured by the operation and thus the perfect nutrition of the fragment is assured.

The patient can eat and pursue his occupation. Two months later, I remove the splint. The alveolar process adheres firmly and then the teeth lacking may be replaced by a prosthetist. In this way, I have already corrected twenty-five protrusions of the upper jaw, and I realized that, by the removal of the protrusion of the upper alveolar process with the frontal teeth, by the lowered arched palate and by the correction of the occlusion, I achieved good functional and cosmetic results. I observed that the speech and particularly the muscles of expression improved remarkably in function as compared with the original state, and the persons afflicted were fully satisfied with the result of the operation.

SUMMARY

The orthodontist and not an oral surgeon determines the indication for surgical interference in cases of the anomalies of occlusion. After the fifteenth year, a markedly developed prognathism especially with defective molars requires surgical interference, because the orthodontic treatment is slow and unpromising.

Precise study of every case on plaster models, the selection of an acceptable plastic operation and suitable splint, with orthodontic correction are necessary to secure the best results possible. As soon as the bone is consolidated, a prosthetic insertion of lacking teeth guarantees a functional and cosmetic success. I am convinced that there is still much to strive for to satisfy the patient and the orthodontist as well.

PROTECTION OF THE INTERPROXIMAL SPACE*

By J. W. SWITTERS, Utrecht, Holland

G. V. BLACK, who in many regards has been a guide for us in the field of operative dentistry, showed us the necessity of protecting the interproximal space by the contact point. In the restoration of carious teeth with proximal cavities, the restored teeth should touch one another at one point, and the interproximal space should again have its original form so that this space can be filled up unhindered by the interdental tissue.

Although Black, in his work on operative dentistry, uses only two pages in treating this subject, he speaks in such a way that we are convinced of the great importance that he attaches to the subject.

To quote:

The shaping of proximal surface fillings to suitable rounded contact point is one of the most important things to be attained. The usefulness of the filling depends directly upon the form given the proximal surface. There is perhaps more failure of fillings attributable to imperfect work in this than in any other one thing in the treatment of proximal surfaces.

The form of the immediate point of contact should be similar to the rounding of the surfaces of two marbles, when placed in contact, and if this rounding can be continued for a space toward the gingival and then the curve reflected to form a concavity, followed by a straight line toward the gingival.

How far it is possible to obtain this ideal form depends a great deal on the shape of the tooth.

The principle of the contact point is treated by Black in a chapter on the finishing of gold fillings. The gold foil filling was much used at that time, and it was very difficult to make a proximal filling of the correct contour which was sufficiently hard at the contact point. Much experience was required to obtain a result which would measure up to the standards of Black.

One of the many advantages that the gold inlay gives is the ease with which it is possible to build up a proximal filling to a correct contact point that is sufficiently hard.

Black's principle, "the protection of the interproximal space by means of a good contact point," can be brought into practice much more easily since the general adoption of the gold inlay.

We will usually, therefore, be successful in restoring teeth with proximoclusal cavities, and they will again be as useful as sound teeth. However, there are always cases that are not successful, and in which our efforts will appear to have failed. Every one of us can recall several similar cases. We have tried our utmost to assure a good contact point, and we have the idea that

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

the result has been a success, and that the interproximal space is indeed protected. At the next sitting, the patient requests us to grind down the filling a little because food remains between the teeth and is difficult to remove. The patient complains of painful gums and has to resort to using the other side of the mouth when eating. On examination, it appears that fibrous food has been retained in the interproximal space and that the gum tissue is more or less inflamed.

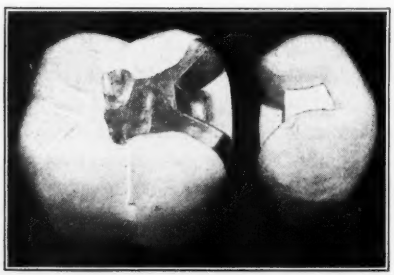


Fig. 1.—Mandibular first molar and second bicuspid with large interproximal space.

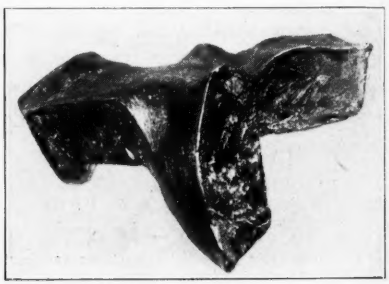


Fig. 2.—Inlay for bicuspid shown in Figure 1.

Occasionally, I have acceded to the desire of the patient when the trouble continued and have ground down large portions of the fillings so that the contact point was entirely gone. The patient was now able to keep the space clean himself, and he was therefore less dissatisfied at the next sitting. But it was not yet quite satisfactory because he could not masticate properly on that side of the mouth.

"While there was a temporary filling, it was much better; I could at least use that side very well," is a comment that I have often heard. And indeed, while there was base-plate guttapercha filling the entire interproximal space, no trouble was experienced.

Complaints of the kind I have just mentioned are not infrequently made by middle-aged or older patients who have one or more of the teeth missing and, on account of this, the interproximal space has been enlarged and the interdental tissue has receded. Usually, the teeth are not any more strongly fixed in position. If, in these cases, we make fillings with a proper contact point, even after separation the result is seldom satisfactory, because the contact point does not remain firmly fixed and the large interproximal space will not thereafter be filled up with gum tissue, not even partially.

The food, especially that of a fibrous nature, is forced past the contact point into the interproximal space, where it remains and is wedged deeper and deeper by the fibrous foods that follow it. This results in irritation and inflammation of the surrounding tissue. The patient complains of pain, which often increases to a troublesome degree in chewing, so that he is, as a rule, forced to use the other side. If both

the cavities are filled with one piece of base-plate guttapercha, we have immediate success. A short time ago, one of my patients whom I had treated in this manner, at the next sitting exclaimed: "I cannot tell you how grateful I am for the service you have rendered me; I have again eaten meat after not being able to do so for several weeks."

Unfortunately, it is impossible to use base-plate guttapercha permanently. It

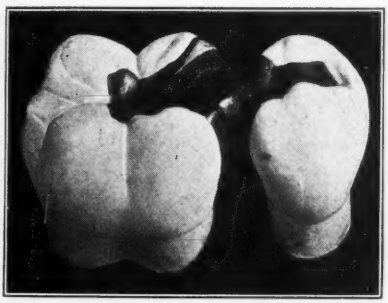


Fig. 3.—Inlays in position.

separates the teeth and the condition is sure to become more unfavorable in the long run. It is therefore necessary to look for a material that has the same advantages as base-plate guttapercha without its drawbacks.

The presence of one gold inlay filling both the cavities will result in the loosening of the inlay in one of the two cavities on account of the individual movement of the teeth. Base-plate guttapercha, on the other hand, does not permit that movement. Supposing that the one-piece inlay does remain fixed, the teeth are liable to become loose. One amalgam filling in both the cavities has the same disadvantages, and there is a great tendency for it to split.

A new method in which we have the advantages of base-plate guttapercha without its drawbacks, and the individual movement of the teeth is permitted and they remain in their position is here illustrated.

Figure 1 illustrates a first molar and a second bicuspid of the lower jaw with a large interproximal space. In the first molar, a gold inlay is placed, having a cut-out portion mesioclusally, and this has a little rounded hollow at the further end of the floor. The inlay for the bicuspid (Fig. 2) is made with an extension to fit into the cut-out portion of the molar inlay. Only the part of the inlay resting in the cavity of the tooth is cemented, and not the extension.

The interproximal space is now sufficiently protected by the inlay with its extension, and the individual movement of the teeth is permitted because the extension is lying free in the cut-out portion, which has been made in such a way that any buccolingual movement is possible. The hollow in the floor of the cut-out in which the extension fits prevents a movement of one of the teeth in a mesial or distal direction. Figure 3 shows the inlays in position.

In several cases, I have experimented with this procedure and have obtained very satisfactory results. The patients were again able to masticate properly; the fibrous food was not wedged into the interproximal space, and thus irritation and inflammation of the surrounding tissue was prevented.

The Journal of the American Dental Association

58 East Washington St., Chicago, Illinois.

C. N. JOHNSON, Editor

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Editorial

THE QUESTION OF ADVERTISING ON THE PART OF PROFESSIONAL MEN

In this age of great activity in the advertising world, and because of the natural desire on the part of advertising agencies and publishers to extend advertising to every calling in life, the question is sometimes raised as to why professional men do not advertise. It could not reasonably be expected that men engaged in the advertising business, and to whom the principle of advertising has become an established article of faith, should be able to recognize readily the distinction between advertising a business and advertising a profession; and yet that there is a distinction, and a very vital one, no one of any discernment who looks into the matter with unbiased eyes can fail to realize.

Recently, the following letter was received in the editorial office from the editor of a prominent newspaper:

Editor,
Journal of the American Dental Assn.,
Chicago, Ill.

Dear Sir:—

I am making a study of the trend towards advertising among members of the medical and dental profession, this being prompted by an advertisement which appeared in a metropolitan newspaper in which a physician and surgeon set forth the fact that he was willing to remove tonsils and adenoids for $25. I am not a champion of advertising dentists or doctors, but merely desire some information, if you will be kind enough to give it to me. For the sake of brevity, I will set out the information I desire in question form.

1. What percentage of the dentists of the United States are what is known as advertising dentists? If you do not know, please make an estimate.

2. How long have advertising dentists been in existence, and is the number increasing or decreasing each year?

3. Do dentists have a formal code of ethics which prohibits advertising, and if so is it possible to obtain a copy of this code?

4. Why do not ethical dentists advertise?

5. Will the time ever come, in your opinion, when the leading men of the dental profession will advertise for business?

I enclose a stamped, addressed envelope for a reply.

Cordially yours.

The following reply was sent:

Dear Sir:

I have your favor asking about advertising on the part of professional men.

In answer to your first question, I do not know definitely the percentage of advertising dentists, but taking a large city as an index, I should say that not more than one or two per cent advertise.

2. Advertising in some form has existed ever since medicine or dentistry began, but unquestionably it is decreasing each year.

3. Yes, dentists have a code of ethics, a copy of which I am enclosing as revised and adopted by the American Dental Association in 1926. There has been a code in existence at least half a century.

4. This raises a question which I should be glad to take up in detail, if I had the time, but briefly I can say that advertising on the part of professional men implies that the advertiser is superior to his fellows and has greater ability—which claim is usually unfounded, and is therefore misleading and demoralizing. No real professional man will vaunt his own personality by advertising—the idea is different from advertising commodities.

5. The time will never come when the leading men of dentistry will advertise.

Thanking you for your inquiry, and pledging my active interest in anything concerning the dental profession, I am

Sincerely yours,

C. N. Johnson.

It would seem desirable at this time, in view of the activity in the advertising world, to amplify the answer to question four in the newspaper editor's letter. It is only just to the advertising interests of the country—who cannot be expected to see anything but virtue in advertising—that a reason be given why professional men do not advertise.

It is not because they wish to assume a holier-than-thou attitude toward their fellowmen, nor because they are opposed to advertising on general principles. They recognize the right of a merchant to advertise his goods, or of a brewery to advertise its beer (when it is within the law), but they honestly believe that there is a difference between advertising commodities and advertising professional service. There is no impropriety in a man's praising his goods, but there is impropriety when he begins to praise himself, and that is precisely what the professional man does when he advertises. To herald to the world one's individual excellence is perilously close to vulgarity, and every time a professional man publishes an advertisement about himself, he is doing this very thing.

Moreover, most advertising on the part of professional men is untrue and misleading; and misleading advertisements of any kind are demoralizing and are beginning to be frowned on by the advertising world—which is a very healthy sign of the times. If a professional man advertises, it is *prima facie* evidence that he cannot gain a practice without it, and this in itself should be considered a reflection on his ability or his aptitude for his calling. A practice which is not gained by recommendation of one patient or client to another is never founded on a substantial basis, and this is why professional men sometimes find the first period of their practice rather slow. To advertise publicly in a situation like this is never to solve the problem. The intelligent

public has developed a suspicion of professional men who advertise, and well it might.

In this connection, we should like to ask the editor of the newspaper just referred to (for whom we have the highest respect) this question: if he had a little boy or girl who was the very apple of his eye, and for whose welfare he would willingly sacrifice his very life, and this little boy or girl should chance to need a tonsil or adenoid operation, would he take the child to the metropolitan man who advertised that he would perform the operation for $25.00, if he knew nothing of the man except what he saw in the advertisement? And if he would not do it himself, would he expect other intelligent parents to do so?

The whole idea of professional advertising is becoming more and more repellent to thinking people. It is not only a tradition but also a principle that is involved, a principle of the highest ethical import, and the more we develop our ideals, the farther we shall get away from this unfortunate practice.

What would be thought of one of the leading lights of law or medicine, or of the ministry, if he inserted an advertisement in the public press lauding his own qualifications to practice his profession? And what would be thought of a prominent dentist, representing even a profession of less than a century of independent existence, if he should issue a public statement that he was better than other men in his calling? Can any one imagine such men as the late G. V. Black, or W. D. Miller, or George H. Cushing, or H. J. McKellopps, or William H. Morgan, or Jonathan Taft, or William H. Atkinson, or a thousand other men who have graced dentistry and given it an established status in the public mind—can any one imagine these men inserting an advertisement in the public prints claiming superiority over other men?

Where would dentistry have been today in the eyes of the world if its representative men had advertised? It would never have been a profession at all—it would have dragged its weary

way along as the tail end of some trade, and it never would have been known as a recognized part of the great health service that is being heralded today as one of the chief factors in promoting the future efficiency and happiness of the people. No, we can assure the editor most emphatically that the day will never come when the leading men of dentistry will advertise.

THE CHRISTMAS SEALS

At the time of going to press with this issue, the sale of the Christmas Seals was slightly behind that of the previous year, a matter difficult to understand in view of the great good that is being done in the way of relief and the larger membership over that of a year ago. The only inference is that many of our members have been careless and overlooked the opportunity to do good through this medium. The cost to each individual is so nominal that it cannot be this. If it were possible for every member to visualize the tangible relief that is being given to some of our needy colleagues through this medium, there would be a hundred per cent response. At least, this would be a reasonable expectation, and yet in estimating this, we are conscious that we lose sight of a certain type of human nature which, even in a profession like dentistry, manifests itself in the most unexpected manner.

In the hundreds of letters that come in from our members—letters that would warm the heart of humanity—there is an occasional discordant note such as the following:

> If dentists would collect the fee they are entitled to for their services they wouldn't be dependent upon Christmas Seals and charity.
>
> If they are so foolish during the productive years of their practice, let them take the consequences. Let some of their good patients for whom they did work "so reasonable" throw dimes in their hats.

This letter, of course, was not signed, but the man who wrote it does not mean literally what he says. He does not mean

that because a dentist may have been foolish during his productive years that he should be called on to suffer the consequences of being obliged to submit to having some one throw dimes in his hat—that he should be reduced to abject beggary. Surely no dentist would want to see that happen to a fellow practitioner.

Nor does our good brother reckon with the possibility of illness entering into a man's life and incapacitating him in his declining years. There are so many of the exigencies of life over which men have no control that no man is justified in passing judgment on his fellow practitioners in a matter of this kind.

No, we think that the plan of the American Dental Association is better than to have any of our colleagues forced to resort to ordinary beggary. The relief fund has brought happiness into too many homes to be ignored as a worthy and noble effort. It has contributed not only to the physical and mental comfort of its beneficiaries, but it has done even a bigger work than this—it has expanded the hearts of the donors, and sent a glow throughout our membership that no other movement has even approached. We are a better association and a better profession because of this effort, and it would be a distinct loss to dentistry in this country to see it lag.

Let every man who so far has neglected to send his contribution do so at once, and feel the same glow that has gone out from the many thousands in the past few months. A permanent record is made of each contribution, and it constitutes itself a real hall of fame for future dentists to contemplate. To be on this list is not only a recommendation but it also will prove a source of the keenest satisfaction for all time. Let dentists be known as men who cheerfully look after the unfortunate and needy in their ranks, and do it without heaping a burden on any individual. It is by far the best method ever devised for relief and is worthy of unanimous support. Send in your dollar at once.

THREE THINGS NECESSARY

To be a successful dentist, three things are essential: culture, capacity and character. A professional man without a certain amount of culture is an anomaly: he is not, in the true sense, a professional man. A dentist may know how to fill teeth and insert dentures, but if he is totally lacking in culture, he will never measure up to the standard of a real professional man.

If, on the other hand, he has nothing but culture—if he is deficient in the practical knowledge of dentistry and has no capacity for doing the routine operations of the day—he cannot expect to succeed in serving the people, nor, in fact, will the people come to him for service. They must be convinced that the man in whom they place their trust is capable of safeguarding their interests, and no matter how learned a man may be, it will not suffice unless he is qualified to perform the practical operations of routine dentistry.

And then beyond this there is the fundamental requirement of character. A man may be cultured as the world knows culture, and he may be proficient in a professional way; but if he lacks moral fiber, the world will have none of him, and the world is right. There is no other single requirement so essential for success in a professional man as stability of character. It is the foundation on which real success is built, not only in professional life, but also in life as a whole.

JOHN MORGAN WHITNEY, D.D.S., M.D.
(1835-1927)

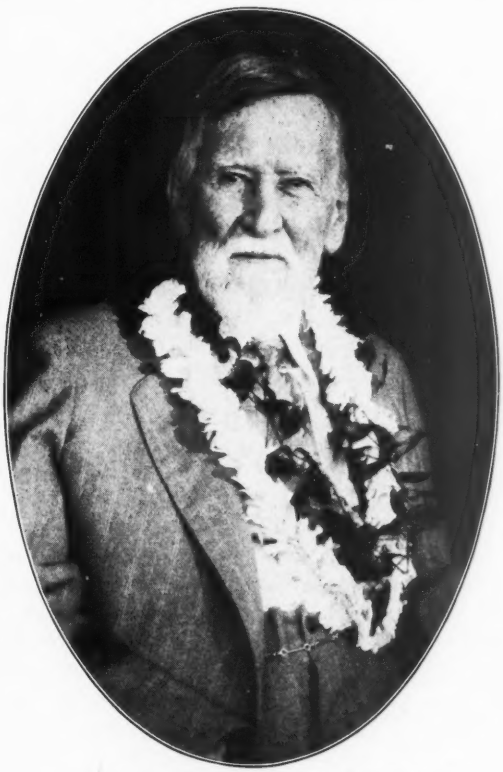
John Morgan Whitney, who retired from the practice of dentistry in Hawaii in 1924, after fifty years of service, was a graduate of the 1868 class of the Pennsylvania College of Dental Surgery and of the class of 1874 of the Starling Medical College. He was an outstanding international figure in dentistry and a contributor to its progress for more than half a century. He was a member of the Territorial and American Dental Associations.

The following is quoted from the *Honolulu Star Bulletin.*

PIONEER DENTIST OF HAWAII PASSES AWAY

Dr. John Morgan Whitney, aged and beloved resident of Honolulu, died peacefully, Nov. 17, 1927, after several years of gradual enfeeblement due to his advancing years. He was 92 years, 1 month and 16 days old.

Death came peacefully to the "kamaaina"—old resident—at his pleasant home set under wide spreading trees on Punahou St.—the same old-fashioned and vine-clad house in which,



JOHN MORGAN WHITNEY, D.D.S., M.D.
(1835-1927)

just a month and a half ago, he welcomed scores of friends who called to congratulate him on his ninety-second birthday.

He came to Honolulu in 1869—when this city was a small, isolated, little known seaport town, with few white people—and practiced dentistry here for more than fifty years. He was the first graduate dentist to practice in Honolulu. He was an authority on dentistry and dental surgery, and wrote several papers of recognized authority on the subject.

He was for forty years a deacon of Central Union church and a charter member of the Honolulu Social Science Association, whose meetings he attended up to his ninety-first year.

DEPARTMENT OF DENTAL HEALTH EDUCATION

FUNDAMENTALS IN HEALTH EDUCATION*

By MARJORIE DELAVAN,† Lansing, Michigan

THAT health education methods and materials are in need of improvement requires no very extensive proof. We admit, most of us at least, that, in too many instances, we have been haphazard in our efforts and faulty in our technic. Our speeches have not always been effective, our pamphlets have not invariably escaped dullness, and our exhibits have not in every case been striking. The question is, can we improve the situation, and how shall we go about it?

There are, to begin with, two very simple tests that we, if we are to fulfil our obligation to the public, should apply more rigidly to all our material, whether it be speeches, pamphlets, exhibits or programs in general.

The first test, one so obvious as to seem axiomatic and yet so frequently disregarded that it demands the utmost emphasis, is that of the sheer scientific accuracy of the things we try to teach. Is the statement that we make honestly true, true in essence and true in implication? Have we actual proof, or are we giving to supposition the weight of fact? Do we *believe*, or do we *know*? Are we quite sure that we are not led by our own interest and enthusiasm to lose our perspective, and to give to our specialty an importance that is not inherent?

The truth, as nearly as possible all of the truth, and certainly nothing but the truth, should be the basis of all health teaching.

But, you may say, how can we apply the test of truth, when truth itself is so elusive? All that we believed yesterday we do not credit today, and what is accepted today may be disproved tomorrow. How can we be scientifically accurate when a few guinea-pigs can so easily prove us wrong?

No one denies the difficulty in the situation. The school men are right when they say that doctors and dentists tell them to do one thing today and another thing tomorrow. It is disconcerting to have to alter your theories of ventilation over the week-end, and to change your food habits over night.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

†Director, Bureau of Education, Michigan Department of Health.

But until the last word is said on these subjects, we will have to accept the situation as philosophically as possible. The only way out seems to be to choose a middle course, to avoid the fads that beckon so alluringly, to pin our faith to the things that seem to have the soundest background of proof, and to be willing to change our minds and our teachings if need be.

However, when a matter is controversial, it is much wiser to admit that it is. Teach it as a possibility but not as a fact. It is no disgrace that in some matters we think, but do not know; the disgrace comes when we merely think and give the public the impression that we know.

Possibly it seems unnecessary to insist at such great length on this rigid application of the test of truthfulness. But you have, in your own specialty of mouth hygiene, some very good examples of the need for it.

Within the last few years, the public, and especially the youthful public, has been swept along on a wave of toothbrushes in a sea of paste and powders. We have chanted that a clean tooth never decays, a statement that rates about as high as the equally familiar one that an apple a day keeps the doctor away. We have, perhaps unwittingly, developed a passion for toothbrushes that, in its way, is entirely laudable, but that has undoubtedly allowed the impression to develop that cleanliness alone possesses more magic properties than it can honestly claim. Now we are faced with the task of restoring the proper perspective, of putting early filling and proper foods side by side with nightly brushing. To the health rule, "I brushed my teeth at least once today," we are adding "I visit my dentist regularly" and "I eat green vegetables and fruit and drink milk." It is merely telling the rest of the truth.

Again, in the matter of using mouth hygiene statistics, we need to ask more carefully this first question, "Is it true?" Too often our enthusiasm leads us astray and we make statements that sound well but do not bear close scrutiny. There is a vast difference between "most common" and "most important." One is susceptible to proof, and the other is not. No one can challenge us when we assert that dental defects are the most common of the defects found among school children. Any one can question our accuracy when we say that dental defects are the most important defects of childhood. Superlative claims are liable to harm our cause more than they help it. There are plenty of arresting facts that prove the need for mouth hygiene measures without resorting to controversial statements.

Granting that our material measures up to this first and most essential test of truthfulness, our next question may well be, "Is it presented most effectively?" Here again, we have too often failed lamentably. We have tried to teach without taking into account the inexorable laws of psychology on which all good teaching depends. Until we apply to our material the test of psychologic soundness, it will continue to fall short of success.

To be effective, any speech or pamphlet or exhibit must be fitted to the group for which it is prepared. And may I digress for a moment on the matter of choosing groups. Massing an attack is always more effective than

scattering forces. Most of us have neither the funds nor the personnel to cover the whole range of our community groups, so the obviously sensible thing to do is to select those that have an inherent interest and that will help to spread the lesson that we wish taught. For instance, public health nurses and teachers are strong allies to enlist in any health education program, and material prepared for them is sure to fill a definite need. It is better in the long run to concentrate and to have a few groups informed to the point of action than to have numerous groups mildly interested.

Fitting material to a group demands careful planning. If you have to deal with varied nationalities, it means making your teaching coincide to a certain extent with racial backgrounds. It means taking into account the early education of the group. One of our most common errors is to presuppose too much information on the part of our hearers; we unconsciously transfer to them some of our own specialized training. It is, of course, neither wise nor tactful to talk down to any audience, but it is essential that we be so explicit that there can be no misunderstanding.

Technical terminology has no place in popular health material. If there is a real advantage to be gained in teaching a new term, by all means let us teach it; but if it is merely a short cut for us, we might better take the long way around. Any new word or phrase should be introduced in terms of the old and familiar. Learning, we must remember, is largely a process of linking up new associations with old ones, and it behooves us to make sure that the new associations we offer connect with the background of our group.

It is always the better part of wisdom, too, to have your speech or your pamphlet dovetail with the prevailing interest of the group, what the psychologist calls the idea in mind. This is just another way of saying that the wise health educator is an opportunist. It was a lucky day for dentists when Lindbergh crossed the Atlantic with his smile. And canny mouth hygiene enthusiasts took advantage of it to the utmost. Especially in work with younger groups, it is good judgment to make sure that your appeal is up-to-date. Better to abandon the effort than to put forward an out-of-date ideal, or an abstract one. We have long since abandoned "health for health's sake" in favor of promises of athletic prowess and improved complexions.

With any group and any type of health education material, there are certain rules of thumb that we can safely lay down. The first is, "Be brief." The second is, "Be simple." And the third is, "Be enthusiastic."

The fault with most speeches and with most bulletins is that they are too long. Most of us could say what we have to say in half as many words and with twice as much effect. Of course, no one would advocate dwarfing an important subject by cramming it into five minutes, but, for most topics, forty-five minutes is amply sufficient. The duration of attention of any individual is definitely limited, and when you exceed that limit, you jeopardize your cause. It is amazing what you can do in the way of condensing your material without loss of meaning or of emphasis. Condensing is an excellent mental exercise and deserves more exploitation by health educators.

Simplicity goes side by side with brevity in turning out effective material. Just as the duration of attention is limited, so the range of attention has its boundaries. Concentrate on essentials, a few essentials, and discard irrelevant details. Too many speeches and bulletins are cluttered up with facts that have no direct bearing on the subject, but were included because the writer did not have the necessary firmness to exclude them. It is fascinating to arrange facts and figures in neat rows and then marshal them into paragraphs, but you are apt to lose your audience in the process. Figures are, of course, especially difficult to handle and should be used sparingly. They are often the framework of your speech, a background for what would otherwise be general statements, and as such they are exceedingly valuable. But their effectiveness should not be endangered by overuse.

As a rule, three main ideas are enough for one speech. Elaborated and reiterated, they are all that the average audience can take home and profit by. Five ring circuses are all very well perhaps for annual conventions of a professional group, but they have little place in the average popular health education program. Simplicity of ideas, of phrases and even of words makes for clearness, and clearness is one of the cardinal virtues in teaching health.

The third rule, "Be enthusiastic," has many ramifications, and endless possibilities. Many a good program has failed because it lacked the impetus of sincere enthusiasm. Many a less worth while program has succeeded because it had just that personal touch. You can forgive a lecturer many shortcomings if he or she has enthusiasm. You can forgive even more fully, if he has imagination. And you can forgive to the utmost if he has humor. Possibly the whole thing is not so serious as we think, or at least as we often act. In any event, a lighter touch now and then is welcomed by the best of audiences and will be remembered long after our laboriously compiled figures have faded quite away.

To summarize:

We admit that health education methods and materials are not all that we might wish them to be. We ought to give better speeches on mouth hygiene, and write better articles. We ought to get more definite results.

We believe that the first test of all health education material, its scientific accuracy, should be more rigidly applied.

We feel certain that the effectiveness of our material could be increased if we tested it from the standpoint of psychologic soundness. It ought in every case to be fitted to the hereditary background, the educational background and the prevailing interest background of the group to which it is addressed.

Brevity, simplicity and enthusiasm are cardinal virtues in teaching health, and deserve the utmost consideration at the hands of all health workers.

DISCUSSION

Gladys Eyrich, Jackson, Miss.: In speaking on mouth hygiene to various groups, it is necessary to emphasize certain phases of the work and subordinate others. There are two

things which can never be subordinated—a program and methods. We either have a definite program which we are following toward a specific goal or we have no program at all, and in the matter of methods we must have some definite things in mind. It would be helpful to teachers of health education if Miss Delevan would use this paper as an introductory chapter for at least five others, developing the points which she has taken up. The presentation to the child is always to me of paramount importance. It is essential in speaking to boys and girls that truthfulness be uppermost in our minds. For this reason, we should try to avoid the expression "perfect mouths" in favor of "O.K. mouths" and make no statement to the child which cannot be proved. As a conclusion for a tooth-brushing lesson, these two statements can be truthfully made: When we brush our teeth our mouths feel better; we look better. Perhaps we would like to add: When we brush our teeth, we are healthier, and we have better grades in school, but we cannot prove that brushing alone will do this. In the matter of effective presentation, facts are often just as fascinating as fancy. For instance, there are more truthful as well as more effective ways of presenting the milk story than with fairies. Rely on results to test the effectiveness of health teaching rather than on the interest manifested by the child at the time of presentation. In teaching lessons to children, the one that goes over is the one that is motivated, that becomes a part of the child life. Miss Delevan made some statements about nurses and teachers with which I am in entire accord. The teacher is the keynote in the effectiveness of our Mississippi program. There is a fact that I should like to add at this time. If the dental hygienist's course must be lengthened, add child psychology, child pedagogy and lessons in education, in public speaking and story telling. Those are the things which my hygienists need when they have not had a background of teaching experience. The fact was mentioned that we should not talk down to a group. This is especially important in talking to children. Do not change the tone of your voice into what you consider suitable for their age. They will resent it, for their greatest ambition is to be "big." So do not say "little folks" or "little people." It is unnecessary to take up individually the splendid points which Miss Delevan presented and summarized so admirably. Our talks would all be more acceptable if we followed her admonition and example, curtly phrased by a philosopher: "Stand up, speak up, shut up and sit down."

TEACHING MOUTH HYGIENE IN TEACHERS' COLLEGES AND NORMAL SCHOOLS*

By ALICE CONGER HUNTER, D.D.S., Des Moines, Iowa

AS an instructor in a training school for teachers, my experience is limited and far from expert. For the past four years, I have been connected with the public schools, as school dentist, in a city having a school population of about 28,000 children, with approximately 1,000 teachers.

My observation has led me to note that school teachers are on a par with all other lay people when the subjects of mouth hygiene and care of the teeth are

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

presented. Their interest increases as they become informed.

Now the number and variety of things expected of the grade school teacher of today is proverbial, so it is little wonder that any request made by the school dentist or hygienist for co-operation in making surveys or home room charts, or in inducing parents to take their children to the dentist is met with indifference or positive apathy. It appears to her already overburdened mind like adding just one more unnecessary and useless task to her day.

But once her interest is aroused by showing her that some little 5 year-old, with thin legs, pale cheeks and dull, tired eyes, numerous abscessed teeth and innumerable sensitive cavities, can be transformed into an alert and sparkling human being, happy to be free from pain and to take a part in the world's work, you have secured an ally in teaching mouth hygiene whose influence and efficiency are immeasurable, and without whose aid all *our* efforts are futile. I am convinced that our greatest degree of success in promoting mouth hygiene will be attained when we have enlisted the interest and hearty cooperation of the grade and rural school teacher who has a knowledge of the subject as a part of her professional training.

After I had held this opinion theoretically for a long time, it was my privilege to spend some time, during the past summer, lecturing to teachers and would-be-teachers in six state normal training schools, the attendance at each of which varied from 130 to 1,200 students, or an average of about 500 each.

My itinerary was planned by the mouth hygiene committee of the state dental society in cooperation with the state department of education, and financed, under the direction of the state superintendent of public instruction, by the six colleges visited.

Having no established precedent to guide me, no charts nor slides, nor other physical aids to teaching, and realizing that the lecture is only one and that not the most effective way of teaching, I entered on the work very much as one about to sail an uncharted sea, but with unlimited faith that the undertaking was worth while.

Since the subject was extracurricular and no tests or credits were given, it is impossible to measure the results of the experiment. The plan suffered the disadvantage of being thrust on an already full program, since each of these summer schools was designed to give those in attendance the maximum of work for credits which could be crowded into each of two six week terms.

Both faculty and students cooperated in every possible way to make the most of the two, three or four days that I was assigned to each school, and even where attendance at assemblies was voluntary, I was greeted by the full attendance of both faculty members and students.

The program varied somewhat in each school and developed of itself as we went along. Immediately on my arrival, I was presented to the entire body of students at convocation, when I could have from fifteen to forty-five minutes in which to introduce my sub-

ject. On two occasions this time had to be shared with another lecturer equally zealous in the interest of his subject, whose dates had by some mistake conflicted with mine. One of these was a representative of the W. C. T. U.; the other, of the Junior Red Cross.

In this first lecture, I dwelt at some length on the history of the mouth hygiene movement, describing some of the experiments made in the beginning. I spoke of Eberhart, of the Marion School experiment in Cleveland, of Dr. Fones and his splendid demonstration in Bridgeport, of Dr. Burkhart's work in Rochester, the Forsyth Infirmary in Boston, the United States Public Health Unit in the south, Mr. Sutton's work in the Atlanta, Ga., school and of the work of some of the state departments of health, such as North Carolina and Massachusetts.

This lecture was designed not only to awaken interest in the subject itself, but also to prove its dignity by the excellence of the company it has kept.

Usually, after this lecture, I was immediately surrounded by instructors inviting me to meet their separate classes. These covered a wide variety of subjects: home sanitation and hygiene, physical education, teaching methods, physiology, home management, home nursing, introduction to education, public health, dietetics, psychology and courses of study and school management, the number of students in each class ranging from ten to fifty or more.

In these classroom talks, I could give more detailed and intensive instruction. I made two general subdivisions of the subject, one of which I called "Nutrition," and the other "Care of the Teeth" or "Mouth Hygiene." Whenever it was possible to meet the same group twice, I used all of the time allowed on each subject. When that was impossible, it was necessary to combine the two into a one-period talk. I found a questionnaire compiled by one of our nurses from questions repeatedly asked of her by parents to be of great help as an outline covering most of the essentials of the subject. The talk could be lengthened or curtailed to fit the time allotted.

As a basis for my teaching of nutrition, I took Sherman's latest edition of "The Chemistry of Foods" and reviewed the findings of Howe, Grieves, McCollum, Toverud, Mellanby and others as published from time to time in the medical and dental periodical journals, dwelling especially on the effects on bones and teeth of diets deficient in calcium and the antiscorbutic vitamins, summing up by giving them Sherman's four essentials of a chemically adequate food supply, as follows:

1. Sufficient of the organic nutrients in digestible forms to yield the needed energy.

2. Protein sufficient in amount and appropriate in kind.

3. Adequate amounts and proper proportions of the various ash constituents or inorganic foodstuffs.

4. Sufficient of each of the essential vitamins.

Since Dr. Towne's little book "Your Teeth," with its supplement which gives the food classifications, is used in all

the schools of the state, I found it and the chart "Tips for the Teeth" very helpful. I tried to show that it is possible for all, rich or poor, to have a properly balanced diet if only a little time and thought is given to the matter; that every family can have access to a cow and a little garden, and that by taking advantage of the bulletins sent out by the various state bureaus and the Department of Agriculture at Washington, vegetables and fruits can be preserved for winter use so that persons far removed from the city markets need not suffer for lack of the essential food elements.

In my talks on hygiene and the care of the teeth, I reviewed the essentials of the anatomy of the parts, their normal arrangement and their functions.

I have lectured once each year for a number of years to a class of about 100 freshmen in a kindergarten college and teachers' training school, and I have never yet found one girl who knew without question how many teeth belonged to the deciduous set. I stressed the matter of brushing as a hygienic necessity, but made no attempt to have toothbrush drills. I had a typodont and a small "Q. T. No." brush, and I demonstrated as well as I could the Charters' method of brushing the teeth. I dwelt at length on the fact that there must be a structure well built upon a foundation of the proper food elements in proper proportions, or the brushing, however carefully done, will not save the teeth.

In this talk, I also explained occlusion and malocclusion, and their effects on health, personality, etc., and this led to a discussion of habits, good and bad.

Another lecture which I used where I could have an additional meeting with a group, I called "Why Save the Baby Teeth and How?" and on one occasion when asked to take the classes of a professor who had to be away for a day, I added a talk on "Dentistry as a Community Problem."

For the benefit of any who might care to use it, and that you may know just the range it covered, Miss E.'s questionnaire is given:

Baby Teeth
- How many?
- Why care for them since they come out after a while?

Six Year Molars
- What are they?
- Where are they?

Why brush the teeth?

When brush the teeth?

How brush the teeth?

Does having the dentist clean teeth harm them?

What harm comes from losing baby molars early?

What is the difference between early or later care of any cavity?

What are "gum boils"?

What harm comes from them? We see from one to several in little peoples' mouths.

Malocclusion
- What is it?
- What causes it?
- Name some bad types.
- Why correct it?

Why chew?

Why is milk needed in the diet?

Why are vegetables and fruits needed in the diet?

What is the relation between teeth and health?

Give recipe for limewater as a mouthwash.

After each lecture, opportunity was given for questions, and while many were too shy to take advantage of it during the class period, there were always some who did and others who

sought an opportunity to question me later.

Many of the instructors were exceedingly alive on this subject and helped to bring out salient points by questions. One in particular was on his toes, even going to the trouble to show me the volume and page in which the author stated in a footnote the exact number per hundred thousand babies having teeth erupted at time of birth. He had a 2-year-old child with malocclusion which he brought to me for diagnosis and advice. I mention this merely as a proof of interest.

It was intended that, in those colleges where no practice school was in session, clinics would be provided so that practical demonstrations could be made of the manner in which any teacher might examine the mouths of her pupils and intelligently advise them. No clinics were provided, so that in three of the schools only were children available for this purpose.

Whenever this opportunity was provided, I felt that I had really accomplished a worth-while piece of educational work. Interest was awakened in some who had up to that time been apparently apathetic to the subject.

This brings me to the point where I am compelled to take cognizance of a situation prevailing everywhere to a greater or less degree, but encountered more frequently in rural communities and smaller towns: the indifference of the members of our own profession to the matter of children's dentistry.

I examined three classes of about twenty children each, ranging in age from 5 to 12 years, in three towns. Some were the children of members of the faculty, of merchants and bankers; others were less fortunately situated. I found mouth conditions similar to those we find among the most neglected and underprivileged children of our city. Most of these children had been taken to the dentist, only to be told there was nothing to do.

I am sympathetically aware of the reasons for this attitude on the part of many dentists, and it is not in the province of this paper to criticize my professional brothers; but surely if we are going to continue our propaganda for better mouth conditions, if we are going to continue to enlarge our circle of allies by enlisting nurses and teachers, we need to have the assurance of the intelligent cooperation of *all* the members of the *dental* profession, near and remote. May I not plead for such?

I am sorry to be unable to prove by statistics or other means the degree of success attendant on this experiment in teaching mouth hygiene in teachers' colleges and normal schools. I have only my own reaction to it which I can give to you. Take it for what it is worth. I believe that a course in mouth hygiene should be added to the regular course in teacher training as a required subject and credit given for work done.

In this state, such a course is required in all public schools, but no preparation for its teaching is required of the teacher; which seems incongruous.

It seems too, that, in order to insure uniformity in method or subject matter, there should be a qualified dentist in the state department, either under the department of health or of education, or financed by both, to act as a director or supervisor of all such teaching; for it involves not only teaching, but also the guardianship of the health of children.

RECOMMENDATIONS CONCERNING DENTAL SERVICE IN STATE INSTITUTIONS*

By WILLIAM R. DAVIS†, D.D.S., Lansing, Michigan

1. A minimum and maximum salary should be established according to the experience and ability of the dentist, with provision that if the dentist has not had previous experience, he be started at the minimum and have a yearly increase, if it is deserved, until the maximum is reached.

2. Full-time dentists should be employed as far as is practicable, and if a dentist serves two institutions, these institutions should be close together, so that traveling expenses will be small.

3. A standardized list of equipment and supplies for dental use in state institutions should be used. This will make the ordering of dental supplies more simple, facilitate the handling of the order and enable the purchasing department to effect a considerable saving of expense in buying dental supplies.

4. An inventory of equipment and supplies should be made when a dentist enters or leaves the employ of a state institution, and from time to time as seems necessary, and a copy of this inventory should be kept in the superintendent's or warden's office.

INSTRUCTION TO DENTISTS EMPLOYED IN STATE INSTITUTIONS

When entering on your position, first go over the list of supplies and equipment to see whether it is complete. If it is not, report the fact at once to the superintendent or warden. When leaving employment, inventory the equipment and supplies with someone in authority, and leave one copy of this inventory in the superintendent's or warden's office and one for your successor. You will be held accountable for equipment according to the inventory.

You should find in your equipment a list of institutional dental supplies. Preserve this and order supplies from this list on requisition blanks furnished for that purpose. Be sure to order by the stock number on this list as the person who fills the order is not familiar

†Director, Bureau of Mouth Hygiene, Michigan State Health Department.

*Shortly after the Bureau of Mouth Hygiene of the Michigan Department of Health was established in 1926, the director was asked to visit state institutions and make recommendations concerning dental service. Most of the institutions had either full or part time service, which differed widely, and no plan or policy had ever been adopted either as to service, inventory or purchase of supplies. The aforesaid recommendations were submitted to those whose names are attached, by whom it was discussed and unanimously adopted. It was not expected to be a last word on the subject, but a step in the right direction. Shortly after these recommendations were submitted, direction of all health service in state institutions was transferred from the health department to other departments; consequently, these recommendations have not been put in force in Michigan as yet. When the director of the Bureau of Mouth Hygiene was asked to discuss this subject at a meeting of the association of state directors in Detroit, during the American Dental Association convention, these recommendations were submitted. The Director of the Department of Dental Health Education asked permission to publish them and they are presented here as a basis for discussion.

with dental goods. Watch your supplies carefully and requisition new supplies in time to have them on hand before the supply is entirely gone. As soon as you put a new engine belt on the engine, order another, to be sure of having one on hand. Do not neglect to put this on the requisition blank at once. In case the handpiece needs repairing send in for another before it has entirely given out, and then send the older one in for repairs. You should have an extra contra angle on hand, and when one gives out, send it in at once for repairs. Occasionally look at the carbon brushes on your engine and order new ones when necessary in order to have them on hand.

Be sure to read occasionally a pamphlet on care of the handpiece, contra angle and engine, and give them the care required for delicate and expensive machinery. Preserve these pamphlets. Clean and oil all equipment as needed. Clean and put the contra angle in oil at the close of the day's work.

Observe order, cleanliness and system in all your work.

Reports should be filled out and sent to the proper office promptly as required.

Requisitions should be sent through the regular channels of the institutions, and everything to be ordered should be ordered in that way.

INSTITUTIONAL DENTAL POLICY

The only reason for dental care for inmates of state institutions lies in the relation of mouth conditions to the health of such inmates. The policy, then, of the dental division in a state institution should be removal and prevention of infection and relief from pain. To this end, as soon as possible after an inmate enters the institution, he or she should have a thorough dental examination and the mouth condition should be charted on the examination form.

A copy of the record of the mouth condition as it relates to the health of the inmate shall be submitted to the medical director after this examination and from time to time as seems advisable.

This should be followed by the appointment at the dental infirmary, where the first aim should be the removal of infection by relieving and treating gum disease or irritation, and extracting all diseased teeth, including those badly affected by pyorrhea. The next aim should be the prevention of infection by filling all teeth having cavities, including the small pit and fissure cavities, wherever a fine explorer sticks at all. Patients should be instructed as to care of the mouth, if they are intelligent enough to follow instructions, in order to assist in keeping it free from infection. If not attendants should be instructed to carry out a daily mouth hygiene program for patients.

Amalgam should be used in all posterior teeth where possible. If this is questionable, use a cement lining or fill temporarily with eugenol and zinc oxid, with a small amount of silver nitrate powder incorporated. Where the use of amalgam is not practicable in posterior teeth, use black copper cement. In anterior teeth use cement or enamel. Employ cavity lining in all deep cavities. Sterilize all cavities with phenol, alcohol, silver deposit or metaphen as indicated before filling. Dry and keep

dry with cotton rolls or a dam while filling.

Gold work and bridgework are not to be used. Root treatment, pulp removal and root filling are not to be done except under most favorable conditions, and in the six anterior teeth only. Pulp removal in these cases should be accomplished under infiltration anesthesia. All posterior teeth which cannot be filled should be extracted without devitalization or root treatment.

In case teeth are extracted or some restoration is necessary, vulcanite full or partial plates are to be used. Even a single anterior tooth can be replaced satisfactorily by a small plate where necessary. Necessity for restoration of full or partial dentures shall be o.k.ed by the medical director.

All inmates should be reexamined at least once a year.

As the foregoing dental service is necessary from the standpoint of health, the state owes it to its inmates of institutions, and it is an economic measure for the state in maintaining the health of such inmates. No outside work is permitted by the institution dentist, and the inmate or his relatives or friends are not permitted to pay the institution dentist for work done in the institution. Patients in institutions are to be treated with the same consideration that would be given a private patient. This is necessary from the standpoint of the operator in his future methods of practice. Local anesthetics are to be used wherever indicated.

The foregoing dental procedures are indicated in all institutions, but are urgent in tuberculosis sanitoriums and in institutions where there are children. Mouth infection aggravates tuberculosis and is a very serious handicap to recovery from this disease. Its presence in children is recognized as a menace to the child's health and education. The removal of all mouth infection should be insisted on in tuberculosis sanatoriums and institutions where there are children, and all measures should be taken to prevent mouth infection.

If the inmates wish gold, porcelain, bridge or other restorations and are able to pay for such services, the work should be done by private dentists outside, and only at the discretion of the superintendent and through his arrangement. This is outside the field of institutional dental service.

The institution dentist should not be expected to render any dental service to the employed staff of the institution except consultation and emergency treatment or extraction for the relief of pain, and no fee shall be charged for this service.

Six hours of actual dental work at the chair is a reasonable day's work for the institution dentist.

The foregoing recommendations are endorsed by:

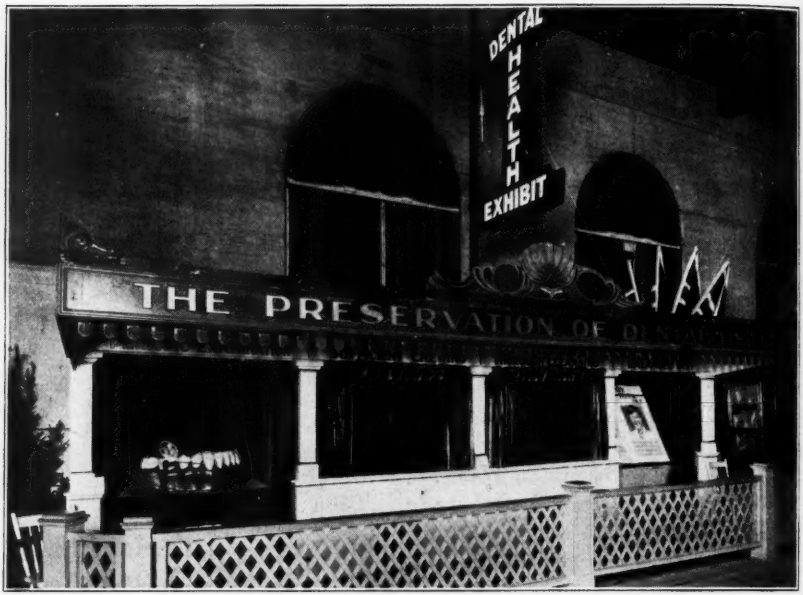
William R. Davis, D.D.S., *Director*, Bureau of Mouth Hygiene, Michigan Department of Health.

C. J. Lyons, D.D.Sc., *Member*, Advisory Council, Michigan Department of Health.

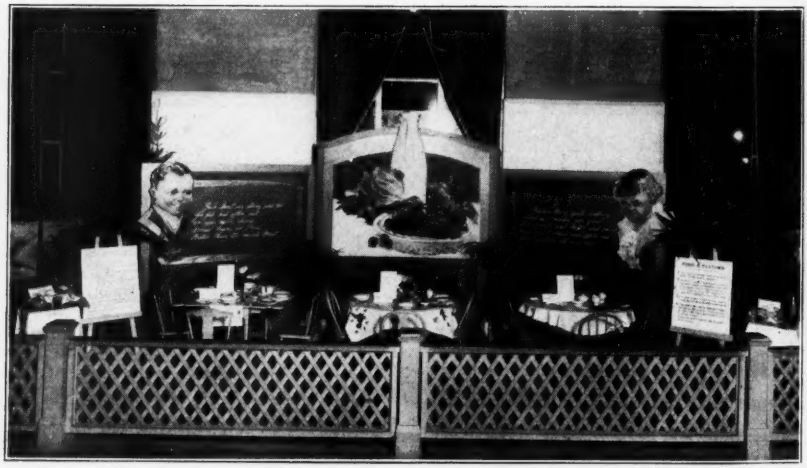
James D. Locke, D.D.S., *President*, Michigan State Dental Society.

Public Health and Mouth Hygiene Committee, Michigan State Dental Society

W. E. Bailey, D.D.S.
W. W. Gibson, D.D.S.
A. C. Thompson, D.D.S.
M. E. Page, D.D.S.



Main display of the Canadian National Dental Clinic.



Tables presenting proper foods for each meal.

CANADIAN NATIONAL DENTAL CLINIC

The Dental Health Clinic at the Canadian National Exhibition, under Dr. Fred J. Conboy, Director of Dental Services, Department of Health, Province of Ontario, was held at Toronto during the last week of August and the first week of September, 1927. The exhibit proved of unusual interest to the 1,800,000 people who attended the fair. It was a teaching clinic, and the exhibit was organized in the form of a theater. A large electric sign over the display announced the fact that dental health was the subject being taught and the large marquee which extended over the front of the theater carried the words "The Preservation of Dental Health."

The main display was divided into four rooms. One contained a large model of teeth, some of which were starting to decay on the interproximal surfaces. A mirror showed the pits and fissures on the occusal surfaces. A nurse in attendance made it clear to the observers that they might have cavities in their teeth and not know it. The model also showed incipient pyorrhea, and the nurse stressed the importance of periodic dental examination in the prevention of both diseases.

The second room represented the stage of a motion picture theater. The story of sufficient mastication as a part of the program for the prevention of dental disease was presented by means of a film-slide machine.

The third room also took the form of a stage and motion pictures were used to demonstrate toothbrush methods. The nurse gave additional information and demonstrated the method by means of a brush and model.

The fourth room contained a large book called the "Daily Dental Diet Book" and, by means of pictures and texts, emphasized the importance of eating more fruit and vegetables and less candy. The question of diet was further presented by three tables, containing proper foods (1) for breakfast, (2) for lunch and (3) for dinner. Attractive school lunches were also displayed.

The director of dental services had his office between the two parts of the exhibit and was kept busy answering questions on mouth health and public dental health services. Four public health nurses assisted in connection with the clinic, and each one was given special instruction in regard to her part of the work before the exhibition started. They were able to answer most of the questions asked them by the public, and when information beyond their knowledge was sought, the inquirer was referred to the dentist.

SUGGESTIONS FOR A HEALTH TALK

The letters "H E A L T H" are being used in a unique and effective way as the foundation for a classroom talk by Dr. Lon W. Morrey, superintendent of mouth hygiene of the Illinois State Department of Health. The letter "H" is written on the blackboard, and the pupils suggest all the words appertaining to health that they can think of beginning with that letter. These are written below the letter "H," and a short health message, based on the word, is given as the word is put down; and so on with other letters. "Happiness" is the word which most of the classes think of first under "H." With the value of mental hygiene becoming more definitely appreciated, and its relationship to general health becoming more clearly understood, it is a hopeful, healthful sign to have this association of ideas in the minds of school children. When the final word after the final "H" has been put down, and the health message told, a summary of the fundamentals of health may be made by the pupils who have been contributing to the story.

Medical and Dental News

Illinois

Dr. Fitzpatrick Heads Club: Gilbert Fitzpatrick, chairman of the Illinois branch of the American Society for the Control of Cancer, has been elected president of the Medical and Dental Arts Club of Chicago pending election of officers and reorganization in March, according to an announcement of the board of governors.

School Dental Clinics: At a recent meeting of the Chicago Dental Society, plans for the installation of dental clinics in the twelve new school buildings to be erected within the next three years was announced by Health Commissioner Arnold H. Kegel. Dental service has been afforded heretofore, but quarters will be set aside for the work of the clinics in the new buildings, with an operating room of two or three chairs and a waiting room. Four million dental operations were performed on 500,000 Chicago school children during the last year.

Dr. Wong Heads Society in China: The first dental society in China has been founded in Shanghai by a group of ethical dentists who are graduates of American, European and Japanese universities. It is said that out of the 1,500 dentists in Shanghai, only 2 per cent have the qualifications to become members. The society was formed after several months of careful investigation by Dr. Benjamin K. Wong, who is a member of the Illinois State Dental Society and a former practitioner of dentistry in Chicago. Dr. Wong graduated from the University of Illinois in 1922 and has been a member in good standing of the Illinois State Dental Society since 1923.—*Bull. Illinois State Dent. Soc.*, January, 1928.

Assistant Superintendent of Mouth Hygiene Appointed: F. C. Belling of Chicago has been appointed assistant superintendent of hygiene. Lon W. Morrey is the superintendent.

New York

Dr. Coolidge Awarded Hughes Medal: William D. Coolidge, Ph.D., assistant director, research laboratory, General Electric Company, Schenectady, has been awarded the Hughes Medal by the Royal Society of England for distinguished work on roentgen rays and the development of highly efficient apparatus for their production. The Hughes Medal was first presented in 1913 to Alexander Graham Bell.—*J.A.M.A.*, Dec. 10, 1927.

Wisconsin

State Society and State Board Members Meet: A joint meeting of the officers of the Wisconsin State Dental Society and the Wisconsin State Board of Dental Examiners was held, December 10, in Milwaukee. This meeting is held annually for the purpose of increasing the membership of the state society and raising the standards of practice. R. H. Volland, President of the American Dental Association, was present at the meeting, which was attended by representatives of the component societies and members of the examining board.

Dr. Donovan on National Dental Board: S. F. Donovan, of Tomah, was recently appointed on the Board of Credentials of the National Board of Dental Examiners.

General

Cancer Society Completes Fund: The American Society for the Control of Cancer announces the completion of their campaign for an endowment fund of one million dol-

lars. The movement was started in the spring of 1926. The fund has been placed in the hands of a trustee, and only the interest is being used. The trustee deed provides that if the society "ceases its work, or if such work shall for any reason cease to be useful," the income is to be applied to worthy purposes in the national health field in accordance with the judgment of a special committee which will be appointed every ten years. A newspaper crusade was inaugurated last spring by a group of New York papers, which recognized the need for correct information regarding the disease, to offset statements made by quacks. At least 176 dailies, distributed in thirty-four states, carried this information.

Deaths

Billings, A. S., Omaha, Nebr.; died, December 6; aged 83. Dr. Billings was one of the pioneer dentists of Omaha. He founded the dental supply house which bears his name.

Davis, James H., Roanoke, Va.; Baltimore College of Dental Surgery, 1913; died, November 30; aged 60.

Evans, John Harvey, Mt. Pulaski, Ill.; Indiana University, School of Dentistry, 1887; died, November 27.

Furman, Joel, Bayshore, N. Y.; University of Maryland School of Dentistry and Baltimore College of Dental Surgery, 1887; died suddenly, November 17; aged 63.

Green, Lelan O., Chicago, Ill.; Northwestern University Dental School, 1896; died, December 14, at Cromanton, Fla., after a short illness.

Henning, J. A., Beardstown, Ill.; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1889; died, December 16; aged 61.

Hume, Bert, Powersville, Mo.; Western Dental College, 1903; was killed in a motor accident, December 4; aged 48.

Lambert, Edmund, Springfield, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1887; died, November 18; aged 69.

Liebstuck, Edward J., Milwaukee, Wis.; Marquette University School of Dentistry, 1903; died, December 5; aged 49.

Maine, Myron M., Bolton, Conn.; Baltimore College of Dental Surgery, 1881; died, November 30; aged 77. Dr. Maine retired about a year ago after practicing nearly fifty years in Manchester.

Marglis, Ralph M., New York City; New York College of Dentistry, 1914; died, December 8.

Miller, John, Detroit, Mich.; University of Michigan, College of Dentistry, 1899; died, December 15, after a prolonged illness; aged 61.

Miller, Julius, Chicago, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1919; died, November 9, of pneumonia.

Oviatt, Harry F., Bangor, Maine; Temple University School of Dentistry, 1909; died, December 12; aged 53.

Potter, William J., Wynnewood, Pa., Temple University School of Dentistry, 1875; died suddenly, December 9; aged 72.

Shilling, Julius Charles, Erie, Pa.; University of Pittsburgh, School of Dentistry, 1925; died in a Pittsburgh hospital from fracture of the skull sustained in an automobile accident, December 9; aged 24.

Shriner, V. R., Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1904; died after a brief illness, November 23; aged 43.

Weller, T. I., Syracuse, N. Y.; University of Buffalo School of Dentistry, 1901; died, December 13, from cerebral hemorrhage; aged 58.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Nature of Cancer: Studies made by Maud Slye have yielded several facts of importance: 1. In every respect, the behavior of cancer observed daily for eighteen years was inconsistent with the germ theory of cancer, or with the diet deficiency theory of cancer. 2. Cancer is not contagious. In the most painstaking and long continued experiments it has never been possible to transmit cancer by contact, whereas all infections here studied have been transmitted by contact. 3. There are apparently two factors necessary for the production of cancer: first, the inherited susceptibility (that is susceptible soil) and, second, irritation or chronic stimulation or trauma of the type fitted to induce it. 4. When irritation to the locally susceptible tissues has been avoided, cancer has not occurred even in susceptible individuals. 5. In every phase of this work, including both etiologic studies and studies in heredity, spontaneous cancer has seemed to be due to the lack of a mechanism fitted to control proliferation and differentiation in regenerative growth processes. 6. Cancer then would seem not to be a degenerative process due either to a specific germ or to diet deficiency, though infections or faulty diet might in some cases supply the chronic irritation factor; instead, it would seem to be a growth process, the result of regeneration which is abnormal because of the lack of a physicochemical mechanism fitted to control proliferation and differentiation. 7. The fact of the inheritability of resistance to cancer is one of the few hopeful observations ever made concerning this disease, because it means that, instead of every one being susceptible, large numbers are wholly resistant. —*J. Cancer Res.*, abstr. *J. A. M. A.*, Dec., 17, 1927.

Rickets in the Negro: A case of rickets successfully treated in a negro boy, aged 2 years, by ultraviolet rays, is reported by Levinsohn (*Am. J. Dis Child.*, December, 1927). The condition was advanced. Healing began in three weeks and was complete in six weeks. That, contrary to common belief, the pigment may not retard the effects of the rays is explained as due to the fact that the rays do not have to penetrate the pigment in order to activate the cholesterol in the epidermal cells.

Physical Defects of Entering College Students: In a tabulation of the diseases, accidents, injuries and other conditions of students entering the University of Kentucky, covering a two-year period, Rush, Tate and Shackelford (*Nation's Health*, December, 1927) found the following dental defects among the 948 entering girl students: caries, 599; removals or crowns, extractions, etc., 83; cleaning indicated, 27; roentgen-ray examination indicated, 25; malocclusion, 21; calculus, 4; gingivitis, 4; orthodontia indicated, 2. Among the 2,004 entering male students, the dental defects found were: caries, 1,446; calculus (heavy), 481; cleaning indicated, 248; extractions, removal of crowns, etc., 147; roentgen-ray examination indicated, 68; malocclusion, 23; gingivitis, 11.

Teeth in Congenital Syphilis: The results of Quinlan's study furnish corroborative evidence showing that the hutchinsonian incisor can be demonstrated by the roentgen ray prior to eruption. The demonstration of the mulberry molar, while not accomplished in this work, is still open to question.—*Arch. Dermatol. and Syphilol.*, abstr. *J. A. M. A.*, Dec. 17, 1927.

Focal Infections: The recognition of "focal" or primary infections is, of course, not new. Comparatively recent, however, is the development of a focal infection fad that finds its expression in the widespread and often indiscriminate removal of tonsils and teeth for the relief of various affections—from asthma to sciatica. Beyond dispute, the extraction of infected teeth or tonsils has sometimes been followed by amelioration of

a chronic arthritis or the disappearance of pains in remote parts of the body. But what is the proportion of such cases in the total of those on whom these operations have been performed for "focal infection"? How many thousand individuals have been made tonsilless and edentulous without any benefit; and what must they think of the physicians who persuaded them to such costly sacrifice? . . . . We would not be understood as condemning either the theory of focal infection or its rational therapeutic application. We cheerfully admit the wisdom of treating or removing any tooth or tonsil that even may be the cause of some obstinate affection that defies all other diagnostic and therapeutic efforts; but we do protest against the hasty and light-hearted extraction of teeth and tonsils, without painstaking observation and examination, and in the face of known pathologic and physiologic processes. Is it not time that the profession take stock of the results of these liberal sacrifices of teeth and tonsils before it is discredited by them?—Editorial, *Am. J. Surg.*, December, 1927.

Treatment of Persistent Rickets: Although rickets usually disappears by the end of the second year, it often persists beyond this age. Eight such instances are presented by Bloomberg. In all, the disease was of an extremely severe type, as evidenced by exaggeration of the usual clinical signs of infantile rickets. Ordinary antirachitic therapy was inadequate; it was only when huge doses of cod liver oil were given along with abundant exposure to the sun's rays that proper healing was obtained.—*Am. J. Dis. of Child., abstr. J. A. M. A.*, Dec. 3, 1927.

Preliminary Medication in General Anesthesia: The removal of psychic impulses, the reduction in the amount of the terminal anesthetic, the increased margin of safety and the prevention of lung lesions are sufficient reasons why preliminary medication should be used with all methods of analgesia and anesthesia.—Hooper and Gwathmey, in *Am. J. Surg.*, December, 1927.

Focal Infection: Sansum is of the opinion that the ethmoidal and sphenoidal sinuses are common sources of focal infection. They were the seat of disease in ninety-nine of 109 cases of various kinds, including thirty-eight cases of chronic arthritis, sixteen cases of chronic parenchymatous nephritis, seventeen cases of neuritis and ten cases of migraine. The frontal sinuses were involved thirty-eight times, the ethmoidal twenty-four times and the maxillary seventeen times. Hyperplasia was present in sixty-three cases, empyema in thirty cases—*J. Radiol.* abstr. *J. A. M. A.*, Dec. 10, 1927.

Carcinoma of Cheek: After exposing the tumor freely on the outer aspect of the cheek, Patterson removes it with the diathermy knife or the saw from within the mouth. There is then a large hole in the cheek caused by the removal of the tumor. The skin flap is turned down and stitched in position. There has been no tendency to sloughing of the skin in the two cases in which Patterson has performed this operation.—*Lancet*, abstr. *J.A.M.A.*, Dec. 3, 1927.

Pathologic Changes of Sea Sickness: It has been suggested that sea sickness is caused by an acidosis, and is curable by the administration of dextrose. Orieal investigated this theory on a human subject. There was a distinct metabolic upset in the prevomiting stage, as shown by (1) hyperglycemia followed by hypoglycemia; (2) increased ammonia excretion, and (3) the presence of acetone in the urine. When vomiting was established, there was a very severe acidosis, as indicated by excretion of large amounts of ammonia and the presence of much acetone and diacetic acid in the urine. The administration of dextrose caused diuresis, abolition of acetonuria, and a fall in the ammonia excretion, resulting clinically in the relief of symptoms. Orieal says that if passengers can be persuaded to eat plenty of fruit and carbohydrates and avoid fats, they are never violently sick. The common error is to avoid food, which, of course, leads to early exhaustion of the glycogen reserve. Acidosis is the inevitable sequel. He suggests that it would be advisable to administer small doses of insulin with a large dose of dextrose to those who are not cured by the adminstration of dextrose alone, as in the hyperemesis of pregnancy, in which this procedure has been adopted with success.—*Lancet*, abstr. *J. A. M. A.*, Dec. 10, 1927.

Necessary Amount of Sleep: Dr. F. A. Moss, professor of applied psychology of George Washington University, claims that the theory of the necessity of eight hours' sleep is erroneous. He even states his opinion that eight hours' sleep as a health requirement "is an outworn Anglo-Saxon myth" and

is a bad habit which cuts down efficiency and dissipates latent powers. His ideas are endorsed by Dr. H. L. Hollingworth, psychologist at Columbia University. Dr. Moss recommends only six hours' sleep, which would give more productive years between the ages of twenty and sixty. Experiments conducted at the Mellon Institute, Pittsburgh, seem to bear out these conclusions, according to Dr. Moss. Dr. Johnson of Pittsburgh concludes that our state of mind determines the reaction to sensations which follow lack of sleep. He is quoted as follows: "Our state of mind has a great deal to do with this habit of sleep. If we do not get our full eight hours at night we are all too ready to blame every ill on lack of sleep. Much of the tired feeling subsequent to going a night without our full quota of sleep exists only in the mind. We think we ought to feel fatigued, consequently we do feel fatigued." The report does not give any information with respect to this claim as to whether Dr. Johnson goes as far as some very good people who claim to believe that all unpleasant sensations are due to a maladjustment of the mind and the invasion of error. Much that these scientists affirm is undoubtedly true, but it is probably equally true that there is a tremendous variation in the behavior of the human mind and body following loss of sleep. Physical and mental stability varies so much and nutritional needs are so dissimilar in various types of persons that one may, with reason, be skeptical with respect to such sweeping statements. —*Boston M. and S. J.*, Dec. 29, 1927.

Cereals and Rickets: If one food habit more than another has a firm hold on the American public it is the eating of cereals for breakfast, probably on account of their variety, the attractive manner in which they are packed and the skillful advertising they receive. About two years ago we called attention in these columns to the announcement by Mellanby that oatmeal would produce rickets in puppies. She believed that there was a toxic factor, which she called toxamine, present in this grain. This finding was contrary to what one would expect from chemical analysis and from the general experience of Scotchmen, with whom oatmeal porridge is the most popular of cereal foods. Recently Steenbock and his coworkers have shown that all cereals have a decided tendency to produce rickets. The feeding tests were carried out on dogs, which are very susceptible to this deficiency disease. The experiments were controlled by careful attention to litter mates, food consumption, growth, X-ray examination, chemical analysis of the blood, ash analysis of bone, and microscopic examination of the costo-chondral junctions, with the result that rolled oats did not make an especially bad showing. Indeed it was somewhat less rickets-producing than maize in both dog and rat experiments, though more so than wheat with rats as the experimental animals. Dogs are so susceptible to rickets that a large number of carefully controlled tests were necessary to demonstrate any difference in the cereals tried. Calcium is the fifth most abundant element in the crust of the earth, so one would hardly expect to find it lacking in the foods commonly used, yet rickets and analogous diseases are quite common in domestic animals such as pigs and chickens. Rickets is a disease due to dietary deficiencies. It may be caused by a deficiency in lime salts or of phosphorus, a disproportion between the calcium and phosphorus, or a deficiency in vitamin D. The requirements for calcium and phosphorus are not absolute, varying with the relative proportion of calcium to phosphorus and the presence of vitamin D. One of the most common causes of rickets is a deficiency in calcium. None of the commonly used cereals contains enough calcium for an adult man when taken as the sole article of food. Polished rice, pearly barley, wheat preparations and patent wheat flour are deficient in phosphorus also. There is no desire on the part of food specialists to limit the use of cereals, but it is necessary to point out their deficiencies and the means by which these can be overcome or corrected. Foods rich in calcium, and in certain cases high in phosphorus also, should be supplied. The treatment of cereals by ultra-violet radiation will also correct the deficiency, since vitamin D is produced by this means in such abundance that the rachitic condition can be much improved even without the addition of the minerals mentioned. In practice, milk, vegetables and certain fruits should be taken in abundance, since they enable us to utilize grains and their products to best advantages in the diet for man and animals.—*Am. J. of Public Health*, December, 1927.

Physical Examination in Removal of Abscessed Teeth: A careful examination of the patient's general physical condition should be made before removing abscessed teeth. Many times the removal of such teeth sets up an acute infection in the abdomen, the kidneys or the heart, or a general septicemia develops, often with fatal results. Dr. Dexter (*Ohio State Medical Journal*) warns especially against wholesale extraction in elderly persons. He considers the two most important factors to be the surgical technic used for the extraction and the condition of the patient. Given a careful technic with a minimum of trauma, wherein not more than one or two teeth are taken at a time, no serious results should follow. In those cases in which resistance is lowered by chronic wasting diseases, the removal of infected teeth should be approached with all the judgment and care possible. No teeth should be removed until a careful study of the individual has shown on the one hand that the teeth are a menace, and, on the other, that the patient is in a condition to withstand such an operation. Observation and study have convinced the author that the abscessed tooth is a potential focus of infection. The author believes that teeth should be removed, but feels that a warning must be given against the indiscriminate pulling of infected teeth. Study of the case must precede the decision that the teeth are to be removed and the extraction must be performed in a gentle and conservative manner, to the end that the attempted cure shall not precipitate serious or fatal results. We should remember that the rough or careless removal of abscessed teeth is fraught with just as great danger to the patient as is roughness or carelessness in any other surgical procedure. It is high time that the physician and the dental surgeon joined together to study this problem, in order that we may learn how to avoid these unfortunate results, which are believed to be vastly more common than the literature would lead us to suppose.—Abstr. *Nation's Health*, December, 1927.

Eye Disturbances of Dental Origin: Fromaget (*J. Med. Bordeaux et du Sud-Ouest*) points out the double mechanism by which the eye may become involved in the course of dental infection. Circumscribed infection of a tooth may irritate the ends of the trigeminal and sympathetic nerves, causing vasodilatation of the eye vessels. Thus, reflex disturbances of the eye occur. Or bacilli may be carried by the blood stream from the dental focus to the eye, where they form a focus of infection. According to Rosenow, the infection is induced chiefly by *Streptococcus viridans*, which seem to have an elective affinity for the eye. They disappear as soon as the infectious process in the tooth subsides. In certain cases, the sinuses play an intermediary rôle between the dental infection and the ocular lesion. Search for the pathogenic micro-organism should be made in the blood, the periapical foci, and, especially, in the root canals. The sinuses, as well as the dental and periapical foci, should be examined with the roentgen ray.—Abstr. *J.A.M.A.*, July 9, 1927.

What America Owes to Medical Science: If there is any one thing which the progress of science has taught us, it is the necessity of an open mind. Without this attitude very little advance could be made. Truth must always be able to demonstrate itself. But when it has been demonstrated, in whatsoever direction it may lead, it ought to be followed. The remarkable ability of America to adopt this policy has been one of the leading factors in its rise to power. When a principle has been demonstrated, the American people have not hesitated to adopt it and put it into practice. Being free from the unwarranted impediments of custom and caste, we have been able to accept whole-heartedly the results of research and investigation and the benefits of discovery and invention. . . . In the development of this general policy the science of medicine has had its part to play. No tendencies in recent history have been more outstanding than those toward conservation and cooperation, both in public and in private activities. For years, the value of conservation of our material resources, forests, mineral deposits, water power, animal life, has been generally recognized. Movements have been started to cut down waste and unnecessary destruction in business and industrial operations. We are practicing economy in our governmental affairs. But the conservation of human health and life is one of the greatest achievements in the advance of civilization, both socially and economically.—Calvin Coolidge, in *Hygeia*, July, 1927.

Care of the Teeth: W. H. Gilmour, professor of dental surgery at Liverpool and president of the British Dental Association, in his presidential address to the association at Liverpool said that the increase of caries bore a direct ratio to the increase of the consumption of sugars. More sweets were consumed today by children and adults. Easily soluble, boiled sweets might not do much harm; sticky and tenacious sweetmeats certainly did, chocolate perhaps most of all. The habit of giving a child chocolate before going to sleep was most harmful. The school dental service was insufficient. Owing to the numbers of children who required treatment and the comparatively few dental officers available, millions of teeth were probably lost because they were not treated at the inception of caries. Greater use of ultraviolet radiation would not only help to build up the child but might raise the resistance to dental caries both in the youth and in the adult. From the dental point of view, nothing was more essential for insuring strong, healthy teeth than suitable diet for the child from birth to maturity. The most useful correctives to modern cooking were fruits and salads, and they were not so freely consumed as they ought to be. On the continent, they formed the termination of almost every meal and the more simple the dressing, the more beneficial they were. Fruit probably stimulated greater flow of saliva than any other food. He believed saliva to be Nature's cleansing fluid, and that if the foods were sufficiently fibrous they formed the mechanical agent, which, by being thoroughly masticated, would remove the need of any artificial cleansing.—London letter, *J.A.M.A.*, Sept. 10, 1927.

Cancer of the Skin and Mouth: The author (James M. King, in *J. Tenn. M. Assn.*) lays emphasis upon the value of the electrocautery in the removal of malignant tumors when the wound is to be left open and treated with roentgen rays. Under local anesthesia, it enables one to do practically a bloodless operation, and the tissue to be severed is in a clean bloodless field. General descriptions are given of rodent cancer and prickle or squamous cell epithelioma, their clinical features, diagnosis and treatment. The large flat epitheliomas the size of a quarter or a silver dollar, ulcerated or not, should be treated with roentgen rays or radium, roentgen rays preferably on account of the area. Large deep-seated nodular or larger ulcerated tumors should first be removed with electrocautery, and then the open wound treated with roentgen rays at intervals, allowing the wound to heal by granulation. The adjacent glands are not to be considered unless it is found that a squamous cell epithelioma has engrafted itself upon a basal cell type. The one necessary requirement for success in handling cancer is experience. Recurrence will appear, if treatment is not thorough.—Abstr. *Am. J. Surg*, June, 1927.

Effect of Race on Tooth Structure: The Department of Health of Bridgeport, Conn., included the nativity of the mother in questions for a recent survey of their 24,000 school children "to determine, if possible, what part nativity played, if any, in the preservation of the tooth structure." The survey included sixteen racial groups and "the group percentage of cavities in the permanent teeth of the children showed a marked similarity instead of a wide difference as might be expected." The examinations were made by dental hygienists but without the aid of explorers, so that it is very probable that the majority of developmental defects or fissures were not discovered. For this reason, although the survey is interesting, it adds little to our meager knowledge of heredity as it influences teeth. Other parts of the survey show the comparison between schools having regular dental hygiene programs and those having no work of this kind. In the schools with regular dental programs the percentage of cavities found in the teeth was about one-half of the number found in the other schools, so the general conclusion that "in the preservation of tooth structure, environment and education apparently play a far more important part than does heredity" is probably true.—Coon and Rosenthal, in *Nation's Health*, May, 1927; abstr. *Am. J. Pub. Health.*

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Association of Dental Schools, March 26-28, 1928, Washington, D. C.

American Dental Association, August 20-24, 1928, Minneapolis, Minn.

American Society of Orthodontists, April 30-May 1-3, 1928, Buffalo, N. Y.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

March (1928)

Louisiana, at Shreveport (8-10).
Montana, at Missoula (29-31).

April (1928)

Alabama, at Mobile (10-12).
California, at Stockton (9-12).
Connecticut, at New Haven (11-13).
Kentucky, at Louisville (3-5).
Maryland, at Baltimore (April 30-May 2).
Michigan, at Detroit (17-19).
New Jersey, at Asbury Park (18-21).
North Carolina, at Charlotte (16-18).
Oklahoma, at Tulsa.

May (1928)

Arkansas, at Little Rock (21-23).
Illinois, at Rock Island (8-10).
Indiana, at Indianapolis (21-23).
Iowa, at Des Moines (1-3).
Kansas, at Topeka (7-9).
Massachusetts, at Boston (7-11).
Missouri, at Kansas City (14-17).
Nebraska, at Lincoln (21-24).
New York, at Syracuse (16-18).
Pennsylvania, at Altoona (15-17).
South Carolina, at Myrtle Beach (21-23).
South Dakota, at Aberdeen (15-17).
Tennessee, at Nashville (8-11).
Vermont, at Burlington (23-25).
Virginia, at Roanoke (29-31).
West Virginia, at Parkersburg (14-16).

June (1928)

Georgia, at Atlanta (13-15).
Idaho, at Boise.
New Hampshire, at North Conway (13-15).
Southern California, at Long Beach (7-9).
Texas, at El Paso (5-7).
Wyoming, at Casper.

July (1928)

Wisconsin, at Milwaukee.

December (1928)

Ohio, at Toledo (4-6).

Chicago Dental Society, at Chicago, January 24-26, 1928.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, June 18, 1928. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Kentucky, at Louisville, June 8-12, 1928. Secretary, Robert L. Sprau, 968 Baxter Avenue, Louisville, Kentucky.

GEORGIA STATE DENTAL SOCIETY

The Georgia State Dental Society will hold its next regular meeting in Atlanta, June 13-15, 1928.

G. A. MITCHELL, *Secretary*,
Candler Bldg.,
Atlanta, Ga.

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

KANSAS STATE DENTAL ASSOCIATION

The next regular meeting of the Kansas State Dental Association will be held in Topeka, May 7-9, 1928, with headquarters at the Jayhawk Hotel.

C. K. WEAVER, *Secretary*,
Clay Center, Kan.

NEBRASKA STATE DENTAL ASSOCIATION

(A correction)

The next annual meeting of the Nebraska State Dental Association will be held May 21-24.

H. E. KING, *Secretary*.

OKLAHOMA STATE DENTAL ASSOCIATION

The encampment of the Oklahoma State Dental Association will be held for fifteen days, June, 1930, at Falls Creek Assembly Grounds.

ROY H. ELLIS.

VIRGINIA STATE DENTAL ASSOCIATION

The annual meeting of the Virginia State Dental Association will be held at the Patrick Henry Hotel, Roanoke, May 29-31, 1928.

W. G. DELP, *President*,
A. M. WASH, *Sec'y-Treas.*,
Richmond, Va.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana Board of Dental Examiners will meet at 8 p. m., June 18, 1928, at the State House, Indianapolis, in the House of Representatives room for the purpose of examining all applicants with proper credentials. Applications should be in the hands of the secretary one week before the board meeting. For applications, clinical requirements and other information, address

J. M. HALE, *Sec'y-Treas.*,
Mt. Vernon, Ind.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

The Kentucky State Board of Dental Examiners will hold their annual examinations June 8-12, 1928, at Louisville.

ROBERT L. SPRAU, *Secretary*,
968 Baxter Ave.,
Louisville, Ky.

NEW YORK SOCIETY OF ORTHODONTISTS

The annual meeting of the New York Society of Orthodontists will be held, Wednesday morning and afternoon, March 14, 1928, at the Hotel Commodore, New York City. All ethical members of the medical, dental and allied professions interested in the study of orthodontics are cordially invited to attend. Programs will be furnished on request.

WILLIAM C. FISHER, *Secretary*,
501 Fifth Ave.,
New York City.

AMERICAN DENTAL ASSOCIATION

The seventieth annual session of the American Dental Association will be held in Minneapolis, Minn., Aug. 20-24, 1928.

ALUMNI ASSOCIATION, UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY

The twenty-eighth annual meeting of the University of Buffalo, Dental Alumni Association will be held March 1-3, at the Hotel Statler, Buffalo.

L. J. GAUCHAT,
Publicity Committee.

SOUTHERN SOCIETY OF ORTHODONTISTS

(A correction)

The Southern Society of Orthodontists will hold the next meeting in the Southern Hotel, Baltimore, Md., April 27-28.

OREN A. OLIVER, *Sec'y-Treas.*

DENTAL HYGIENISTS ASSOCIATION OF THE STATE OF NEW YORK

The eighth annual meeting of the Dental Hygienists Association of the State of New York will be held at Syracuse, May 16-18, 1928. A cordial invitation is extended to dentists and dental hygienists to attend the clinics and literary meetings.

ALTHEA R. READ, *Chairman*,
Publicity Committee,
52 West Chippewa St.,
Buffalo, N. Y.

NEW ISSUE OF POLK'S DENTAL REGISTER SOON TO BE PUBLISHED

The publishers of the Dental Register announce that information for the Fourteenth Revised Edition is now being gathered.

A questionnaire has been mailed to every dentist in the United States and Canada, whose address could be secured, and all members of the profession are urged to fill out and return this blank at once. A return envelope has been enclosed for convenience.

It does not follow that because you are a member of a dental society, or that because your name and address appeared correctly in the last edition of the Register, it will be included in the 1928 issue. A new, first-hand, registration is being made, and every dentist should appreciate the importance and value to him of having this information published.

Former classmates, friends, patients, business acquaintances and others require this, and, without it, the impression is created that those not included have passed away.

A most commendable spirit of good-fellowship is indicated by several who make it a practice to forward complete lists of dentists in their cities, or counties, through clipping the information from the classified telephone book or otherwise. This cooperation is of great assistance to the publishers and similar lists from others naturally will be appreciated.

However, the most important thing is for *you* to send in *your* registration at once.

There is no obligation involved, it takes but a few moments, and the matter is of sufficient importance to justify your careful attention. An up-to-date, complete directory of the profession is very desirable at this time and we again urge your immediate action.

Please take one of these steps at once:

1. *Complete and return the information blank you received.*

2. *Write for a blank to be forwarded to you.*

Those who have retired, or are engaged in other occupations, are noted in the Register as "retired." Membership in the American Dental Association also is indicated. Information is wanted from all who have graduated in dentistry or registered to practice in the United States, the Philippines and the Canadian Provinces.

If you are among the living, indicate it by communicating with the publishers, R. L. Polk & Co., 536 South Clark St., Chicago, Ill., U. S. A.

COMPETITION OF THE COMMISSION FOR SCIENTIFIC RESEARCH OF THE F. D. I. FOR THE PURPOSE OF SOLVING THE PROBLEM OF TREATMENT OF INFECTED ROOT CANALS WITH SPECIAL REGARD TO FOCAL INFECTION*

1. Any dentist who is eligible for membership of the F. D. I. may take part in this competition.

2. A detailed description of the technic ready for print together with the methods of control applied by the competitor to prove the quality of his work must be given. This paper must be presented to the national committees of the respective countries, and it is their task to apply any type of method they consider most efficient for critical examination. Methods of root canal treatment which have been published elsewhere can also be presented.

3. The National Committees as well as the International Board of Examiners are at liberty to request the competitors to demonstrate their methods on a dummy or on patients.

4. The competitors can be present at the scientific control experiments of the Board of Examiners and, as far as considered admissible, they can operate with them.

*Outline forwarded by Bernhard Gottlieb of Vienna, with the request from him that suggestions be made by men interested in pulp canal work as to possible improvements or additions to the plan, which is to be proposed to the Executive Council of the F. D. I. at their next meeting.

5. In root canal work all cavities that are filled with dead masses, the walls of those cavities and the adjoining tissues, both dentin and cementum, must be rendered sterile, while the associated alveolar tissue must be freed from infection and made to heal. An ideal result would be *restitution ad integrum*. The substitution of this paradental tissue by scar tissue is still considered a satisfactory result. A scrupulous cleansing of all cavities from necrotic material is the *ideal* precondition. If complete correction of the damage is accomplished by means of another equivalent method, this is acceptable. The care of the cavities after sterilization must be such that the risk of reinfection in any way is impossible.

6. As regards examination rules, patients from whom, for the purpose of replacing a denture, it is necessary to extract teeth, should be asked to have the proposed method applied to their infected roots before extraction. These roots should be extracted at the earliest after two months under sterile conditions. The fundus of the alveolus as well as the sterile capped apex should be tested as to their sterility by the most modern research methods. The reliability of the root canal filling with regard to permeability for fluids and microorganisms will be shown according to well-known bacteriologic and principles of physics.

7. Proof of the efficiency of the presented methods will be made by the national committees and by the International Board of Examiners. In each country which has to examine a presented method, national committees will be elected by the national organizations. The national committees will control the methods presented and forward them to the International Board of Examiners, adding their opinion. The International Board of Examiners, consisting of three members, is elected by vote. Each nation which takes part in the presentation of the prize has the right to nominate three persons. Each nation is allowed votes in proportion to the sum of money subscribed by them, one vote for each $100. The International Board of Examiners is at liberty to choose the form of control experiments. Expenses will be defrayed by by the F. D. I.

8. Twenty-five per cent of the sum available for the prize will be placed on deposit for three years after the distribution of the prize. It will then be awarded to the method which has proved to be the best one according to the experiences gathered within that period. The conditions for the second distribution will be given at a later date. Of the remainder, 25 per cent will be awarded for the solution of the problem of complete evaluation of the pulp canals, 25 per cent for sterilization, 30 per cent for the root filling and 20 per cent for the best method of treating vital teeth.

RESOLUTIONS ON THE DEATH OF HOLMES C. JACKSON

At a meeting of the Faculty of the New York University College of Dentistry, Wednesday, Oct. 26, 1927, the following Resolutions were unanimously adopted:

WHEREAS, the New York University College of Dentistry has sustained a most serious loss in the death of its beloved dean, councillor and friend, Holmes Condict Jackson, who gave his life to science and medical and dental education, be it

Resolved, that we, the Faculty of New York University College of Dentistry, in executive council assembled, do recall with love and admiration his great worth as a leader and executive, scientist and educator. We feel a deep sense of grief in the loss of a man of such exalted character and sterling integrity. And be it further

Resolved, that the Secretary of the Faculty be instructed to inscribe these resolutions in the minutes of the meeting and to forward a copy to the family of the deceased.

MARSHALL S. BRAUM, *Dean.*
W. H. O. MCGEHEE, *Secretary.*